VOLUME XXI NUMBER SEVEN

THE NATIONAL GEOGRAPHIC MAGAZINE

JULY, 1910

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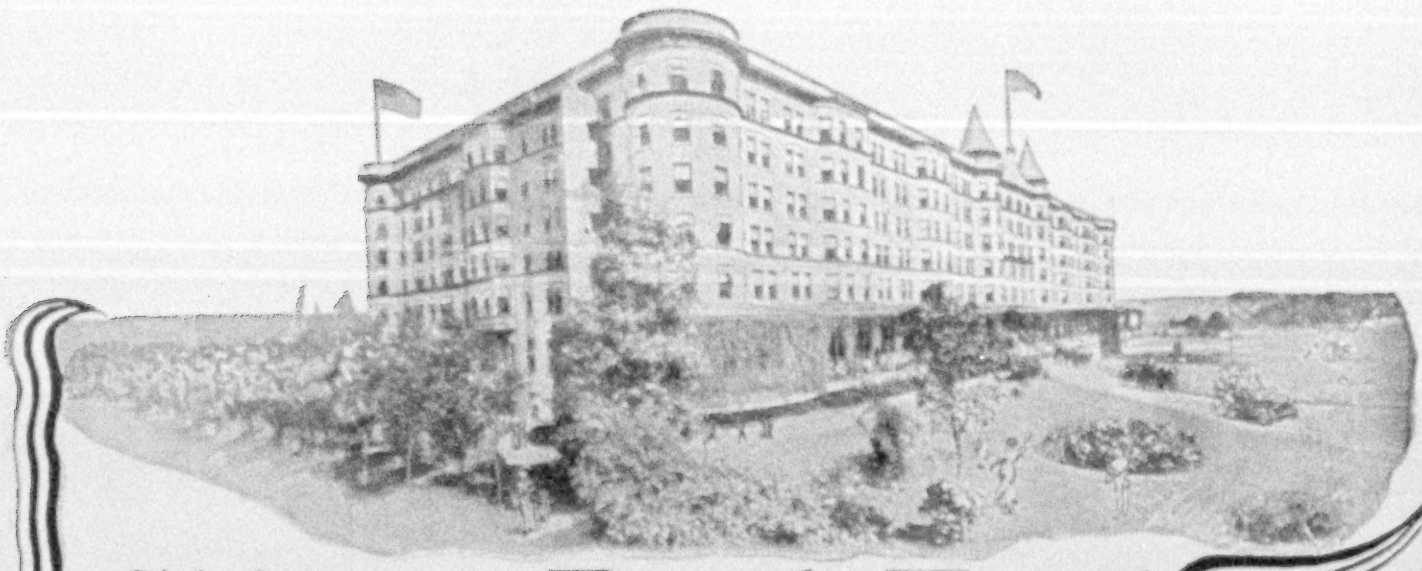

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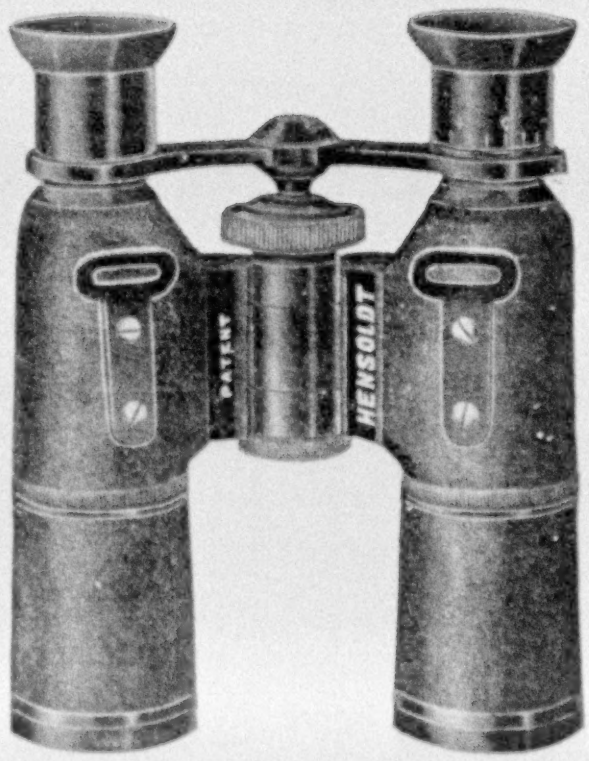

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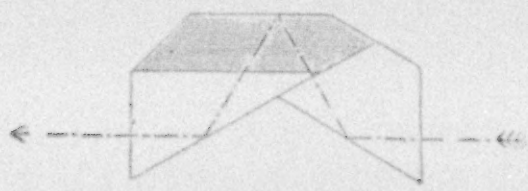

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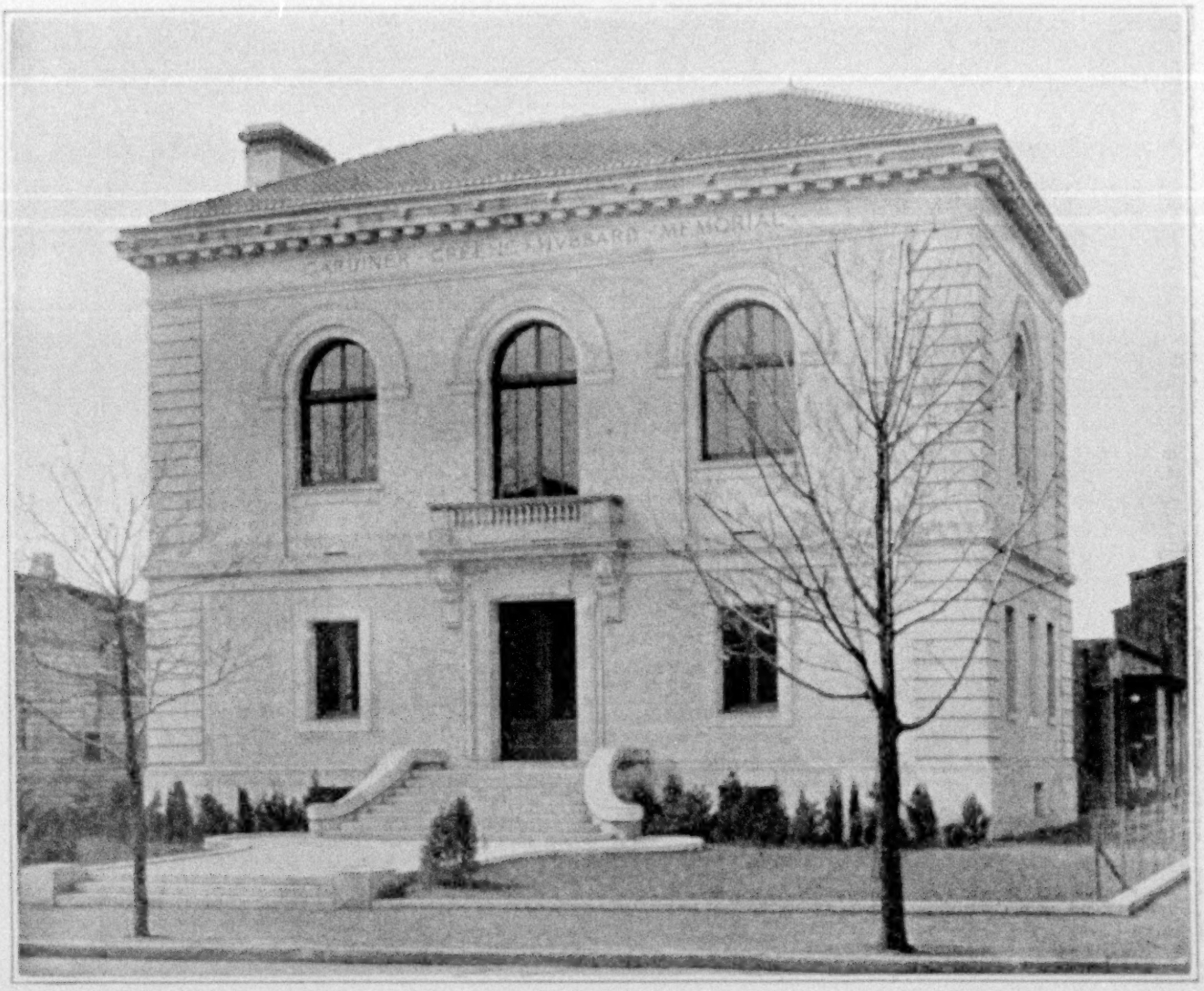

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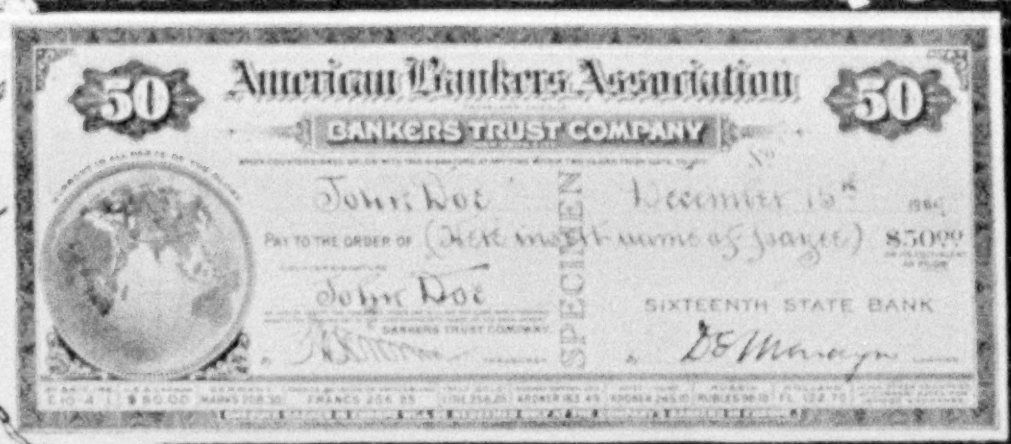

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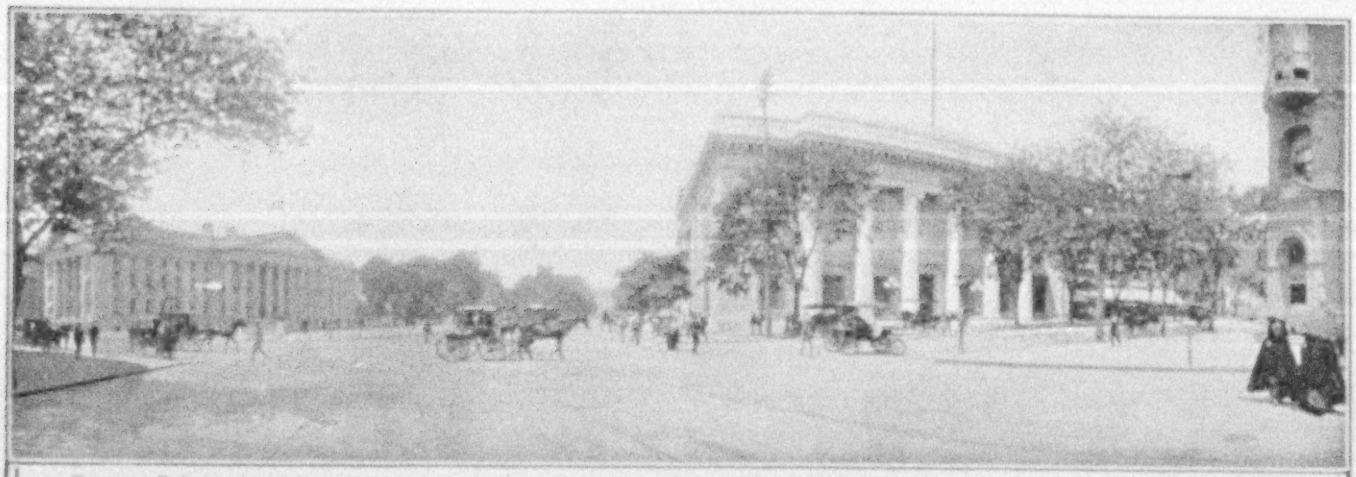

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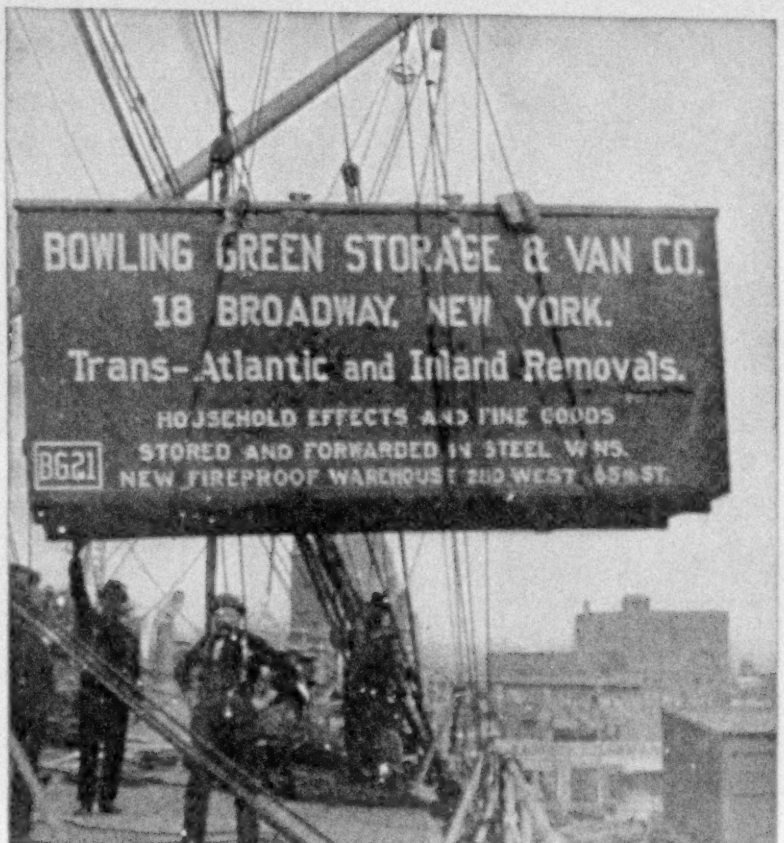

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VOL. XXI, NO. 7 WASHINGTON JULY, 1910

THE NATIONAL GEOGRAPHIC MAGAZINE

THE DATE GARDENS OF THE JERID

BY THOMAS H. KEARNEY

With Photographs by the Author

"WITH its feet in the water and its head in the fire," as the Arab proverb has it, the date palm is at home in the vast deserts that stretch from Morocco to the borders of India.

It thrives where the air is almost absolutely dry and where the summer temperatures are the highest on the globe. Under these conditions only do the best varieties of dates reach perfect ripeness. But as it is also necessary that the roots of the palm find plenty of moisture in the soil, the fruit is confined to the oases—favored spots in the deserts where never-failing springs or wells allow of irrigation.

No country is more celebrated for the excellence of its dates than the Beled el Jerid (Land of the Palms), a small group of oases situated at the northern edge of the Sahara and distant about 250 miles southwestward as the crow flies from the city of Tunis.

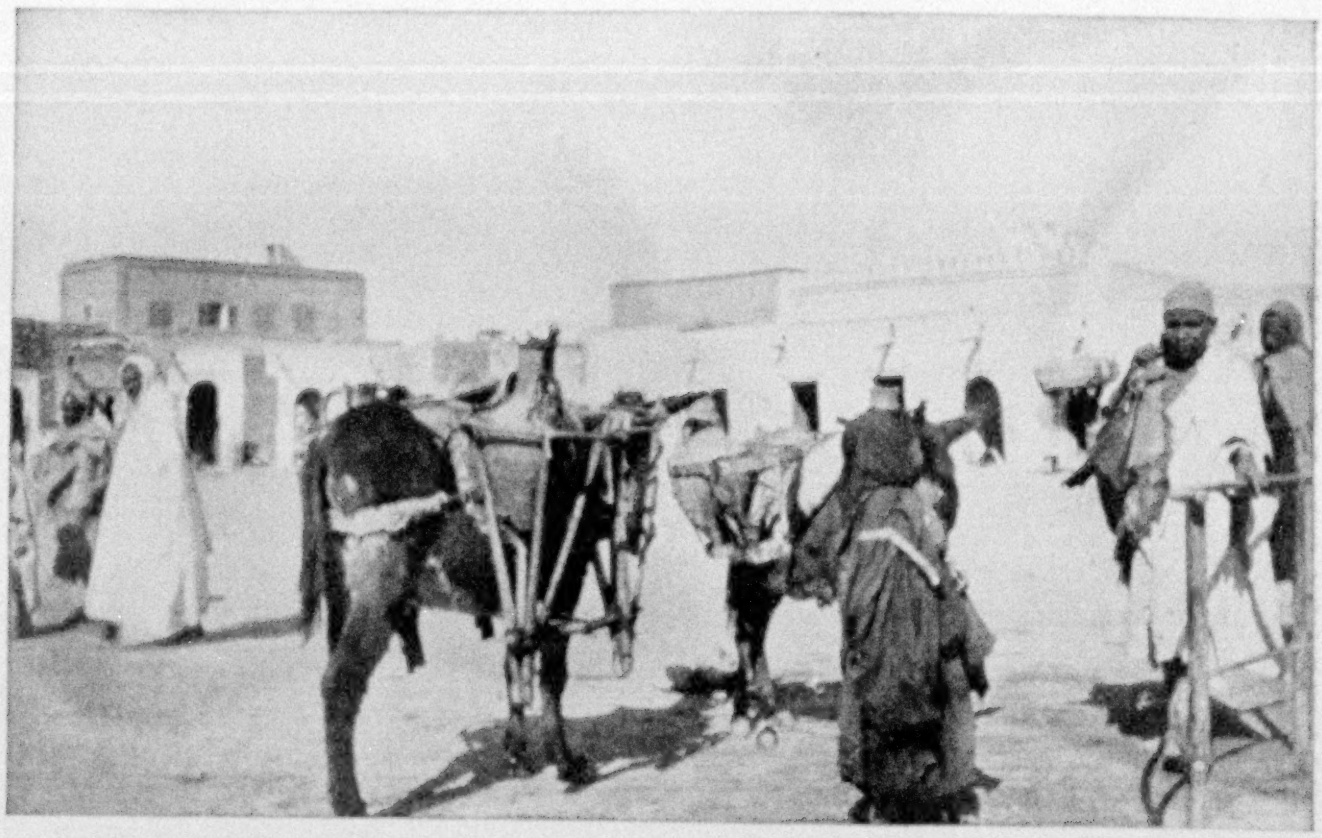
Some years ago I visited these oases in order to obtain palms for the date orchards which the National Department of Agriculture has established in Arizona and in the Colorado Desert of California.* My visit was so timed that I reached the oases soon after the beginning of the harvest. This made it possible to test the fruit of the different varieties while fresh from the trees and to select the best of them for introduction into the United States.

The Jerid is best reached by means of a railway which crosses southern Tunis from the busy little seaport of Sfax, on the east coast, to the rich phosphate mines of Metlaoui, near the Algerian frontier.

Leaving Sfax one morning in October, an all-day journey in a slow mixed train brought me to Gafsa, 25 miles from the end of the line. It was a desolate country through which we passed, wonderfully like the high plains of eastern Colorado and New Mexico.

An occasional cluster of "gourbis," or tents of skins, an occasional flock of multicolored sheep and goats, tended by half-wild Bedouin children, were the only signs of life in the monotonous landscape. The vegetation consisted

* In the southwestern United States there are deserts as hot as the Sahara. Rivers and artesian wells supply water for the irrigation of many thousands of acres. In the belief that the physical conditions meet all the requirements of the palm, the Department of Agriculture is devoting much energy to establishing date culture in this region. During the past ten years agricultural explorers have visited many parts of the great desert zone of the Old World in search of the best varieties.



MARKET PLACE AT TOZER

chiefly of brown clumps of the grass called "alfa" or "esparto," the long tough leaves of which are pulled by hand and shipped in bales to Europe for making baskets, straw hats, and paper of fine quality.

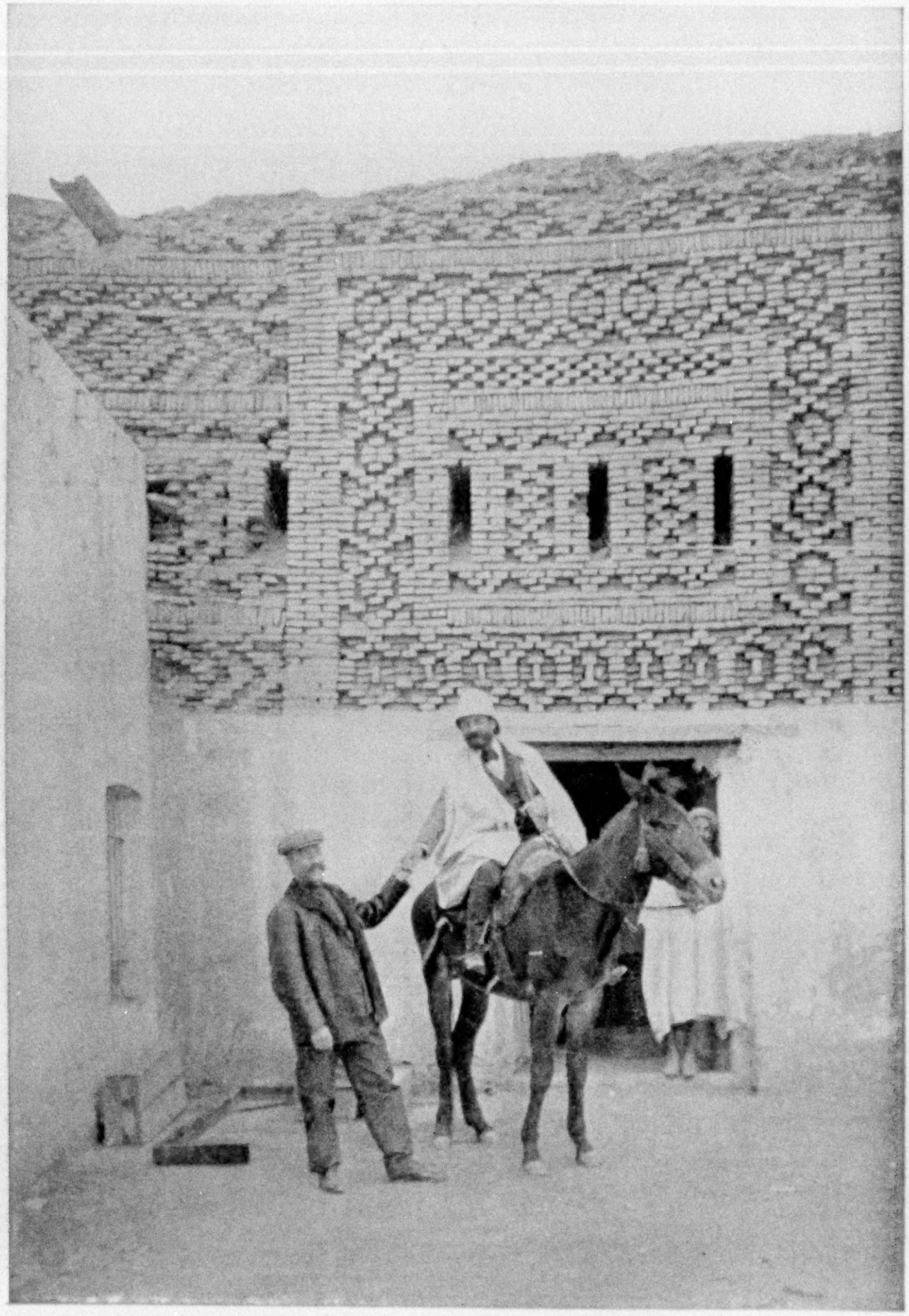
After spending the night at Gafsa, I was up betimes and took an early train to Metlaoui, the terminus of the railway. Here I was met by two Arab boys with donkeys sent by the Contrôleur Civil from Tozer, the chief town of the Jerid. A discharged soldier, returning to his oasis home at the expiration of his service in a regiment of "spahis"—the Franco-Tunisian cavalry—invited himself to join our company. It was a 35-mile ride over the desert from Metlaoui to Tozer.

Although late in October, the heat was intense. The road—a mere track and hardly distinguishable—followed part way the stony bed of a dry "oued," and then struck out across the desert. Overhead was the cloudless sky, underfoot the blazing sand, and around us the sharp forms of desert mountains, devoid of soil and trees. At midday we lunched in the scanty shade afforded by the mud brick walls of a little "bordj," a walled enclosure where travelers may encamp and, if need be, defend themselves against marauders.

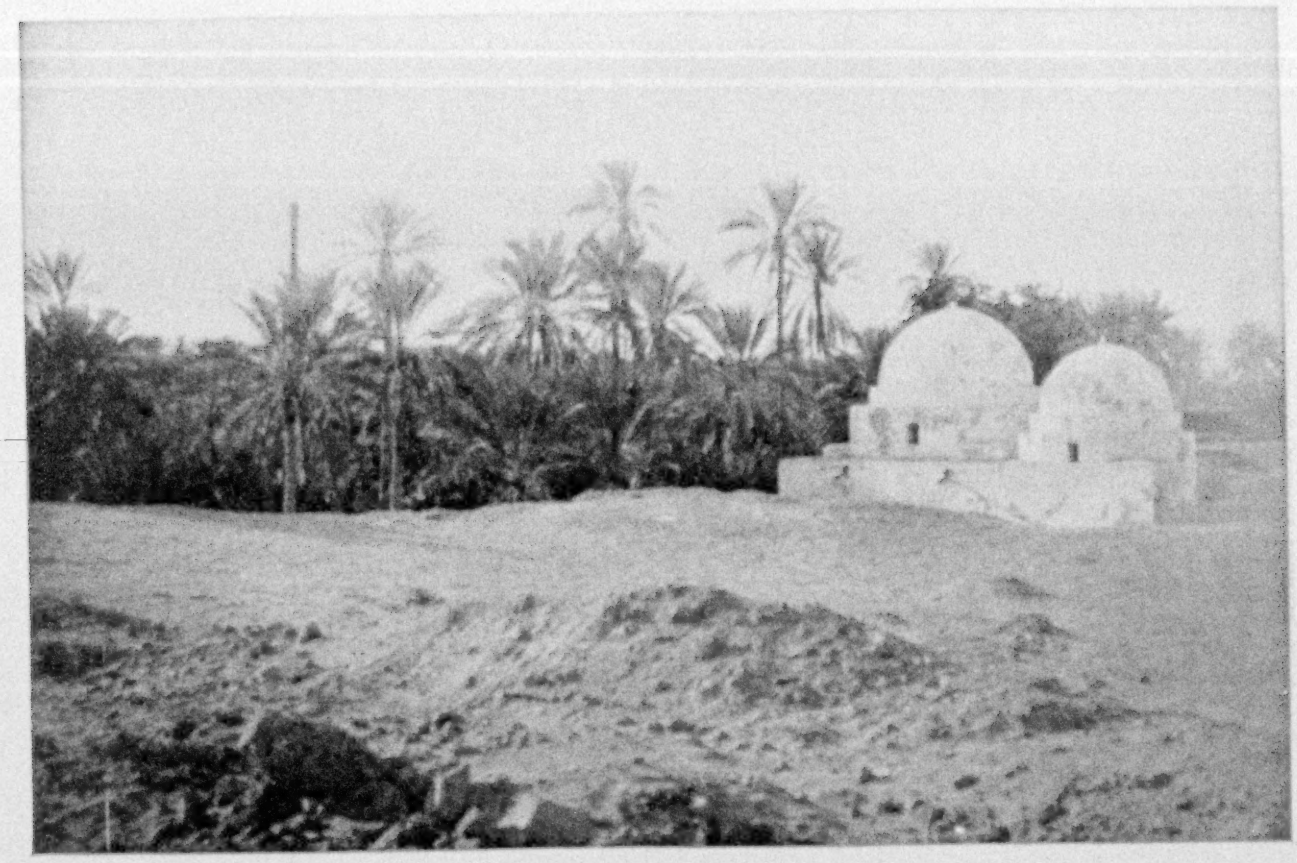
The Arabs, who had hitherto beguiled the way with gutteral chatter and laughter and occasionally with a nasal chanting that kept time to the jog trot of the donkeys, were silent during the long, hot afternoon. Towards evening the air freshened and our tired animals quickened their steps. Alighting for a moment, Yusuf ben Mohamed, the ex-spahi, adjusted his fez with the aid of a pocket looking glass. Then, taking from his wallet a sash of crimson silk and giving one end of it to the donkey boy, he turned round and round until it was neatly wrapped in many folds about his waist. We were evidently nearing the end of our journey.

A few minutes later we paused on the brink of a deep ravine and saw before us—sharp and black against the red evening sky—a long fringed line of palm crowns. It was the oasis of El Hamma, the first of the Beled el Jerid. We skirted a corner of this oasis, passed through its

Dates grow in large bunches which contain hundreds of the fruit. Some of the clusters are so heavy that the fruit must be straddled on the nearest leaf stalk (as in this illustration) to prevent the stem of the cluster from being broken by the weight.



THE HOUSE AT TOZER IN WHICH THE AUTHOR ROOMED FOR SIX WEEKS



TOMB OF A MOHAMMEDAN SAINT AT THE EDGE OF TOZER OASIS

mud-brick village, and, after 9 miles more of donkey back, reached Tozer.

It was none too soon, for I was well nigh exhausted with the fatigue of bestriding all day the huge padded saddle on which the Arabs generally sit cross-legged. After a hasty dinner, I was installed in the one-storied house, built around three sides of an open courtyard, which was to be my home for the next six weeks.

In the morning the first duty was to present my credentials to the French administrator of the Jerid region. That functionary, who enjoys the double title of "Contrôleur Civil" and "Vice-Consul," received me courteously and detailed a spahi to accompany me in my explorations of the oases. Mounted on a fine gray horse and wearing a uniform consisting of a sky-blue burnous over a white "haik" or jacket, my guide made a picturesque figure. The one-eyed El Hachemi ben Achmid, who spoke passable French, was engaged as interpreter, and was thereafter a constant attendant during my stay in the Jerid. A scrawny boy who carried the camera completed the retinue, and without further loss of time we started for the gardens. Crossing the open market-place, on which face the modest public buildings, and winding through a series of narrow, crooked streets, we soon found ourselves on the outskirts of the town. Here, in a shallow stream, naked children were disporting themselves, and women, with skirts tucked up above their knees, were washing clothes. We then traversed a few rods of bare sand and plunged into the oasis.

The transition from the blinding glare outside to the cool shade of the gardens was delightful. Entering one of them, we found it a jungle of date palms, planted in no apparent order, some so close that the stems almost touch, and in other places far enough apart to leave room for little patches of vegetables and lucern and tender young barley. Beneath the tall palms there were other trees—figs, apricots, and olives.

Huge grape vines hung in festoons from the trunks, and long runners of melon and cucumber trailed over the ground. Here and there oranges and

THE TOWN OF NEFTA

The town is built on higher ground than the date gardens, which are unhealthy to live in (see page 554)

big rosy pomegranates gleamed in their setting of dark glossy foliage, and the jasmine, with its white corollas, starred the semi-twilight. Beds of scarlet peppers glowed like fires in the deep shadows among the trees.

The first garden we visited was the property of a wealthy sheik, who was waiting to receive us. The old gentleman's wrinkled brown face, picturesquely framed in the snowy folds of a huge turban, was all alight with cordiality as he led us, with many a greeting of "Salam" and "Sahha" (health), to a hut in the center of the grove. There were assembled his gardeners or "khammes." They were dark-skinned, sullen-looking men, clad in shirts and short baggy trousers of coarse blue cotton cloth, with arms and legs bare. A brief order from their master sent them scampering up the scaly palm trunks. In a few seconds they were with us again, the loose folds of their shirts bulging with dates of many kinds.

The harvest was already in progress, and it was interesting to watch the manner of gathering the fruit. Dates grow in large bunches, weighing from 10 to 40 pounds, which hang beneath the crown of leaves on long yellow or orange-colored stalks, hard and polished as ivory.

An expert workman, known as the "getaa," climbs to the top of the palm, gripping the scaly bark with his bare toes. He is armed with a "mengel," an iron knife, having a heavy serrated blade at right angles to the shank, which is set in a wooden handle.

Severing the stalk with a stroke of his knife, he gives the heavy cluster to the man who straddles the trunk just under him. It is then passed from hand to hand by men and boys who cling to the tree, one below the other, until it reaches the ground.

The number of the rungs in this human ladder depends, of course, upon the height of the palm. Sometimes seven or eight men beside the getaa are required.

Only the best varieties of dates are handled thus carefully; for the ordinary sorts it suffices to toss the cluster to the ground, where they are caught in sheets. They are then packed in skins or baskets to be kept for local consumption, or they are exchanged for wheat and barley, which the nomads of the high central plateaux of Tunis and Algeria bring down to the oases in the fall on the backs of their camels.

The fine Deglet Noor dates, of which the Jerid exports from one to two million pounds every year, are prepared for shipment before leaving the gardens. No curing is necessary. The divisions of the clusters are separated, the unripe and the spoiled fruit is culled, and the dates are packed on the branch in the wooden boxes in which they are despatched by parcels post to Europe. The finest are afterwards selected and arranged in the small oblong boxes, decorated with gaudy lithographs of palm trees and camels, that are seen in our fruit shops at Christmas time.

Riding back to Tozer at noonday for luncheon and siesta, we could make but slow progress because of the crowds that thronged the bridle paths among the gardens. Here and there where two roads crossed were stationed venders of broad beans. The beans, almost as large as chestnuts and not unlike them in flavor, were boiled in petroleum tins over charcoal fires and were sold hot to laborers and idlers.

The air was resonant with the shrill "ir-r-r-a" of the donkey boys and the shouts and songs of men and children. For the time of date harvest is a halcyon season in the Beled el Jerid. The long hot summer is over. The days are still comfortably warm and the nights just cool enough to be bracing. Dates are to be had for the asking, and all the world is well fed and contented.

In the afternoon we sallied forth for another visit to the gardens, returning through the cool twilight. Then for the first time I could appreciate the full beauty of the oasis. The level rays of the setting sun lit up the palm tops, turning the dull purples and maroons of the fruit clusters to glowing crimson and their stalks to burnished gold. Against

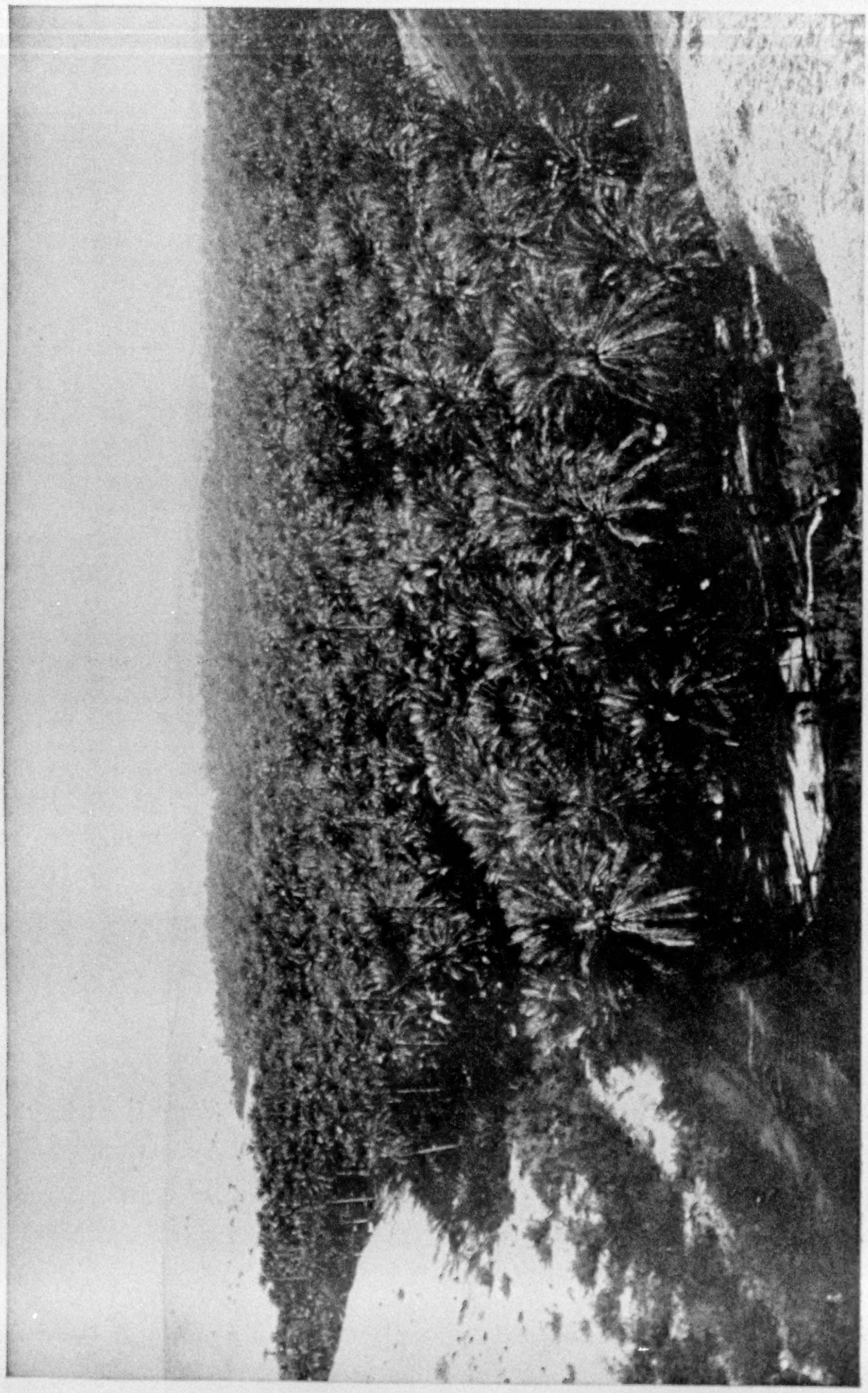


Photo by F. Soler

A GREAT ORCHARD OF DATE PALMS AT NEFTA (SEE PAGE 551)

Note the hollow in which the palms grow

the clear beryl green of the eastern sky the feathery leaf crowns were silhouetted. Overhead a star or two began to glisten in the azure that was fast changing to dusky violet.

Day after day of the delightful Saharan autumn was spent in these explorations, so that I soon became familiar with the topography of the region. The Jerid oases are four in number. Tozer and Nefta, which comprise about 6,000 acres each, are the largest. They are separated one from another by a few miles of sandy desert, where stunted gray bushes are the only vegetation during the greater part of the year. Immediately behind the oases rises a steep bluff, which here forms the northern boundary of the Sahara. The date gardens occupy a gently sloping shelf about one mile wide between this and the Shott el Jerid, a great shallow pond, usually covered with a glittering crust of salt and containing water for only a brief time after the infrequent winter rains. It is one of a chain of such dry lakes that stretches from near the eastern coast of Tunis to the Oued Rir country a few miles south of Biskra, in Algeria.

There are said to be nearly one million date trees in the Jerid. Each oasis is a dense forest, of which the ownership is much divided. The individual holdings range in size from a few square rods to several acres and are separated by "tabias," walls of dried mud surmounted by a palisade of the thorny palm leaves.

Numerous springs, gushing forth at the base of the escarpment that shelters the oases from the north winds, furnish an abundant and constant supply of water for irrigation. At Nefta the springs are situated in a deep basin, of which the sides are much higher than the tallest palm in the beautiful grove that covers its floor. This is the "Ras el Aïn" (Head of the Spring), which the French call the "Corbeille" or basket.

At Tozer and at Nefta the water of the springs is gathered into one large canal. It is then diverted by means of dams situated at convenient points into the irrigating ditches that penetrate every corner of the oasis. Long, shallow notches are cut in the palm log that forms the weir, and the number, length, and depth of these notches determines the amount of water received by the several divisions of the canal. Two guards are stationed day and night at each weir to regulate any dispute that may arise over water rights. To facilitate irrigation, the gardens are divided into little plots or basins, separated by low mud dikes.

More than one hundred distinct varieties of dates are grown in these four small oases. There is a bewildering amount of diversity in the shape, color, and flavor of the fruits. Some are round as apples, others egg-shaped, others finger-shaped. They range in size from that of a small hazel nut to the bigness of a man's thumb. When ripe they are of every imaginable hue, from golden brown to prune purple, and even jet black.

Very fanciful are the Arab names of many of the varieties: "bride's finger," "father of the cucumber," "ox brain," "pigeon egg," "gazelle's horn," are literal translations.

Some kinds are hard and dry, only moderately sweet, and have a nutlike flavor. These "dry dates," which can easily be kept for a year or more, are a staple article of food throughout northern Africa and southwestern Asia. They form a compact and nutritious ration, especially suitable for carrying on the long caravan journeys.

Other kinds, soft as butter and dripping with syrupy juice, must be eaten the moment they ripen. The excessively rich and sweet sorts are used only as a dessert.

The Deglet Noor—the name is sometimes translated "Date of the Light"—is the only variety exported in large quantity from Tunis to Europe and America. It is neither an extremely dry nor a very soft fruit, but has a firm, clean flesh, translucent as cloudy amber, and can be kept in good condition for several months after it is harvested. The inimitable

ENTERING ONE OF THE GARDENS WE FOUND IT A JUNGLE OF DATE PALMS

Photo from David Fairchild

AN IRRIGATING CANAL IN A DATE ORCHARD

flavor of this variety is the standard of excellence in dates.

No farmer's boy is more of a connoisseur in the qualities of the different kinds of apples in his father's orchard than are the Jeridis with respect to dates. Each of the best varieties has its partisans, and there is keen rivalry among the proprietors of gardens in extolling the merits of their favorite trees. The choicest fruits are picked one by one as they ripen in the clusters and are kept by the owner for his own table and for gifts to his friends.

One of the finest of all dates, rivaling the Deglet Noor in flavor and much larger, is the "Menakher," an extremely rare variety peculiar to the Jerid. When I sought to learn why a date which they esteem so highly should be so nearly extinct, the natives told a story that is a curious commentary on the state of Tunis before the French occupation. The Beys, it seems, were exceedingly fond of Menakher dates, and no other sort was served at their banquets. Each year, at the time of harvest, their agents visited the oases and took possession of the entire crop, usually without paying for it. The people wearied finally of this extortion and ceased to plant Menakher palms. They went even further, cutting down many of the old trees in their gardens.

The towns of the Jerid are situated on higher ground just outside the oases. They thus escape to some extent the malaria that lurks in the gardens, where frequent irrigation keeps the soil constantly moist. Even the gardeners dwell mostly in the villages and trudge every morning to the scene of their labors. Only during the ripening season, when the fruit of the choice varieties must be guarded against thieves, men camp among the trees in little palm-leaf tents, which are sometimes elevated on posts at a corner of the wall to afford a better lookout.

The houses are of sun-baked brick, similar to the Mexican adobe. In the façades of the more pretentious buildings the bricks are arranged in curious geometrical patterns, the only attempt at exterior ornamentation. The indispensable date palm furnishes whatever wood is needed in construction. The narrow streets are frequently arched over, making a deep shade that is very grateful at noonday. Benevolent householders sometimes place benches outside their doors in these arcades, where any passer-by is welcome to repose himself.

The population of the Jerid numbers about 30,000 souls, whose livelihood depends almost entirely upon the product of their palms. The Jeridis are sedentary, seldom venturing far from the shelter of the oases. They do not wander over the plains with flocks and herds as do the Bedouins farther north, nor are they conductors of caravans like their Algerian neighbors, the Soufis. They are a peaceable folk, and ever preferred paying tribute to making armed resistance in the days when the Touaregs and other warlike tribes of the Sahara were wont to raid the oases. They have lived for unnumbered centuries in the villages where we find them today, desiring no occupation but the care of their date gardens.

The beauty of their gardens was celebrated by the Arab geographers of the Middle Ages. In yet earlier times, when Tozer was the Roman Thusuros and Nefta was called Nepte, the oases existed, although possibly the olive rather than the date palm was then the principal tree.

Like nearly all successful agricultural populations of the Barbary States, the inhabitants of the Jerid are primarily of Berber stock, belonging to the race that peopled northern Africa before the coming of the Phœnicians and the Romans. But there is a large admixture of other racial elements, notably of the Arab and negro. The small tradesmen and handicraftsmen are mostly Jews. One even sees occasional individuals who have fair hair, blue eyes, and a light complexion, inherited perhaps from some Vandal conqueror or Christian slave of a later epoch.

A charming little denizen of the villages is the sparrow that nests in the

THE GARDENS ARE DIVIDED INTO SMALL PLATS BY MEANS OF LOW DIKES OF EARTH TO FACILITATE IRRIGATION

TURNING OVER THE RICH BLACK SOIL WITH THE MESSAH OR SHORT-HANDLED HOE, WHICH IN THE OASES DOES ALL THE DUTY OF A PLOW AND CULTIVATOR

(SEE PAGE 557)

chinks of the mud-brick walls. This is not our dingy city bird, but a glorified sparrow, who wears a dainty dress of russet and steel blue. Earliest dawn arouses him to cheerful twitterings and occasional snatches of sweet song. The Arabs call this bird the "Bou Habibi," the "Father of Friends," and believe that he brings good luck to any house in which he makes his nest. He is strictly a town dweller, never venturing into the desert and seldom met with in the gardens. Nothing in common has he with such nomads as the linnet and the skylark. He will not live in captivity, and attempts to naturalize him no farther away than the city of Tunis have always failed.

The Ramadan, the Lent of the Mohammedans, commenced ere I had been many weeks in the desert. From sunrise to sunset the natives took neither bite nor sup. By the middle of the afternoon the people of Tozer would be faint with hunger, and huddled in silent groups at the edge of the town, watching the sun as if conjuring it to hasten its setting. The moment it disappeared, the signal was given by a small cannon installed for the purpose in the market place.

Instantly all was noise and motion. Fires were lighted everywhere. The air was filled with the grateful odor of cooking. Lamps were hung out on the minarets and laughter and song resounded from every house. Most of the population devoted the entire night to revelry and were unfit for work in the daytime. The feast of the "Little Bairam" follows the month of fasting, and it was during those three days of childish merrymaking that I left the Jerid for a season.

Early in February I alighted once more from the "train mixte" at Metlaoui and rode southward across the desert. It was a brilliant day, the sky blue as turquoise, the air soft and warm. Crested desert larks, near relatives of the European skylark, rose at every few steps, scattering showers of low plaintive notes. This lark and the little black and white "Comforter of the Camels" were the only birds I saw in the open desert.

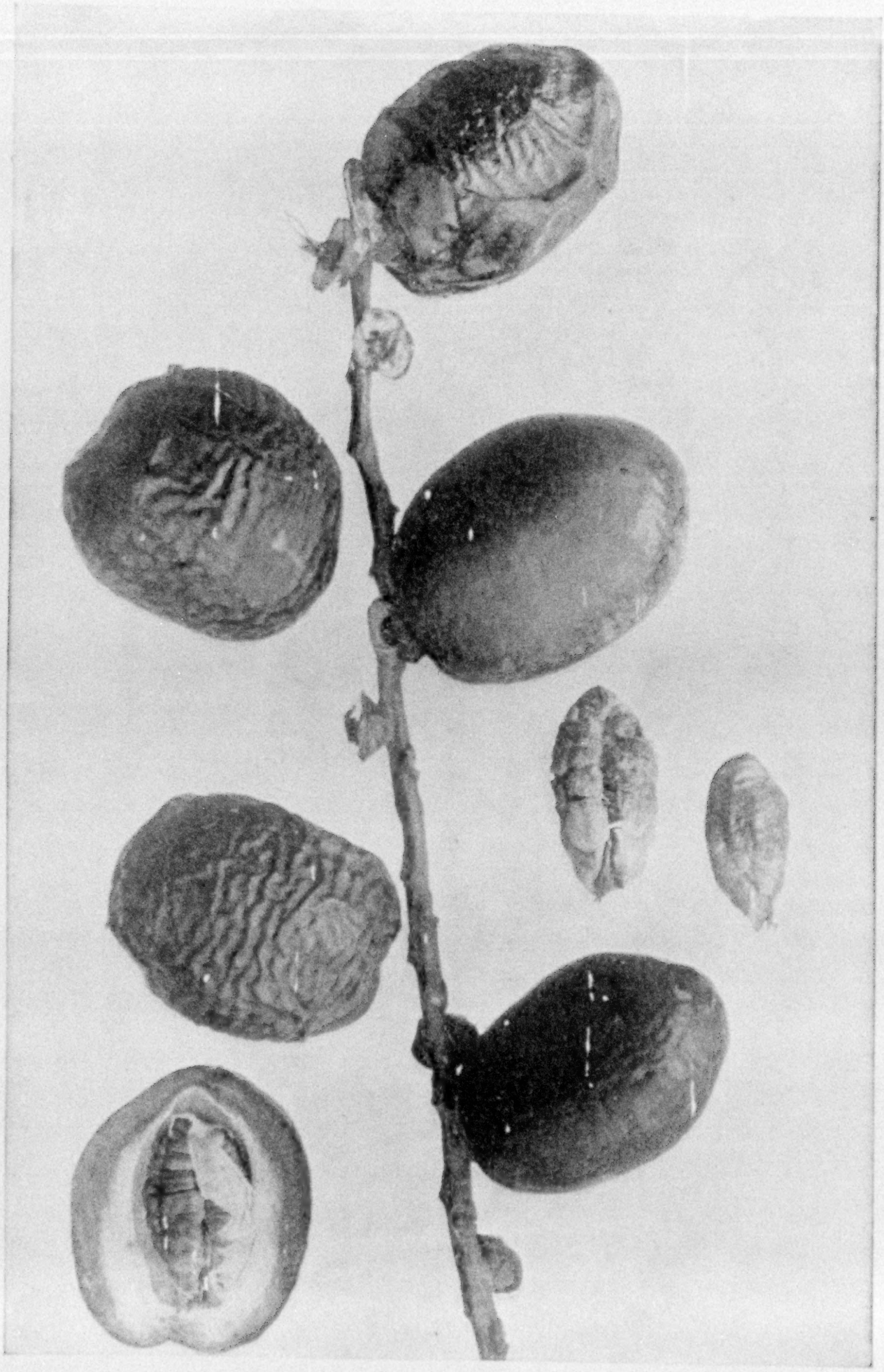
When I reached Tozer the gardens wore a changed aspect. The palms were bare of fruit. Here and there among their rough brown trunks gleamed the tender pink of blossoming apricots. The buds of the fig trees were beginning to disclose the lovely green of their young leaves. Hosts of linnets sang all day long in the palm tops, recalling the choirs of gold finches on May mornings at home. Gardeners, stooping low to their work with the "messah," the short-handled hoe, which in oasis agriculture does all the duty of plow and cultivator, were turning over the rich black soil.

The object of this second visit was to purchase and prepare for shipment the palms that had previously been selected for introduction into the United States. The date, be it said, like the apple and other fruit trees, does not "come true from seed." There is almost infinite diversity among the seedlings, with small chance that any will bear fruit exactly like that of the parent tree. It is only by taking up and planting the leafy shoots that spring from the base of a palm that the variety can be maintained unchanged.

The offshoots are fit to be removed and planted when they have begun to form roots of their own. The Jeridis say they are at their best for starting a new tree when their trunks are of the size of a camel's head. The oasis gardener, when about to take up one of these baby palms, first trims back its outer leaves, so that only two feet or so of the thorny stalks remain. He next digs a hole around and beneath it, severing its roots. With a heavy chisel he proceeds to divide it from the parent trunk. The roots are then cut off close to the stump and the offshoot is ready to be planted.

If it is to be transported to a distance, the base of the little palm is dipped in puddled clay to poultice its wounds. It is then snugly wrapped in several layers of "lif," a coarse brown-matted fiber that grows around the bases of the leaf stalks of the date. The wrapping of lif is secured by cords plaited from the same material. So wrapped, a healthy offshoot can be shipped without risk to the ends

XUM



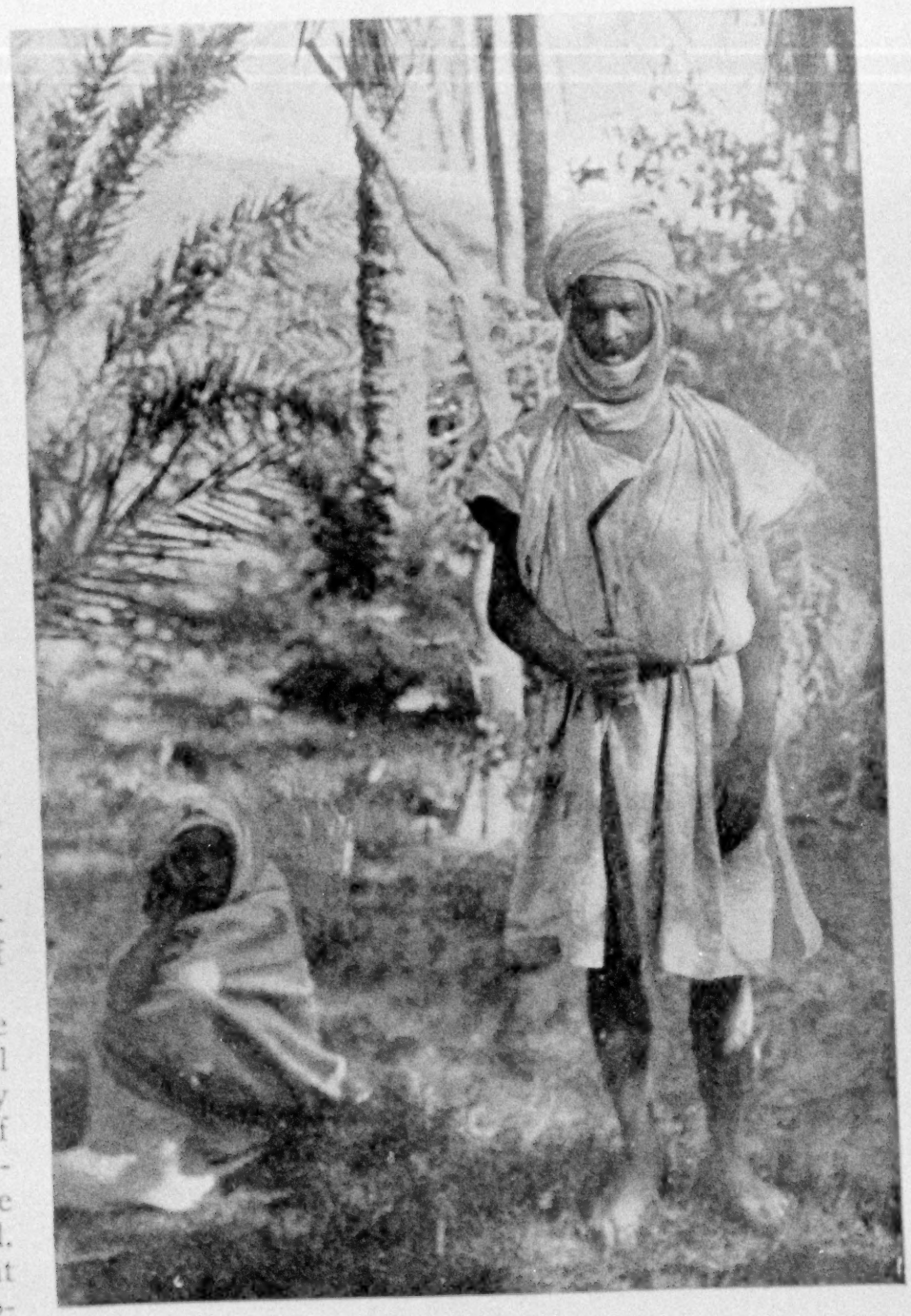
A "SOFT" TYPE OF DATE (TRONJA), WHICH KEEPS FAIRLY WELL

Some are round as apples, others egg-shaped, others finger-shaped. They range in size from that of a small hazelnut to the bigness of a man's thumb (see page 551)

of the earth. It is by virtue of this simple method of packing that the Department of Agriculture has succeeded in introducing many of the choicest varieties of dates into Arizona and California.

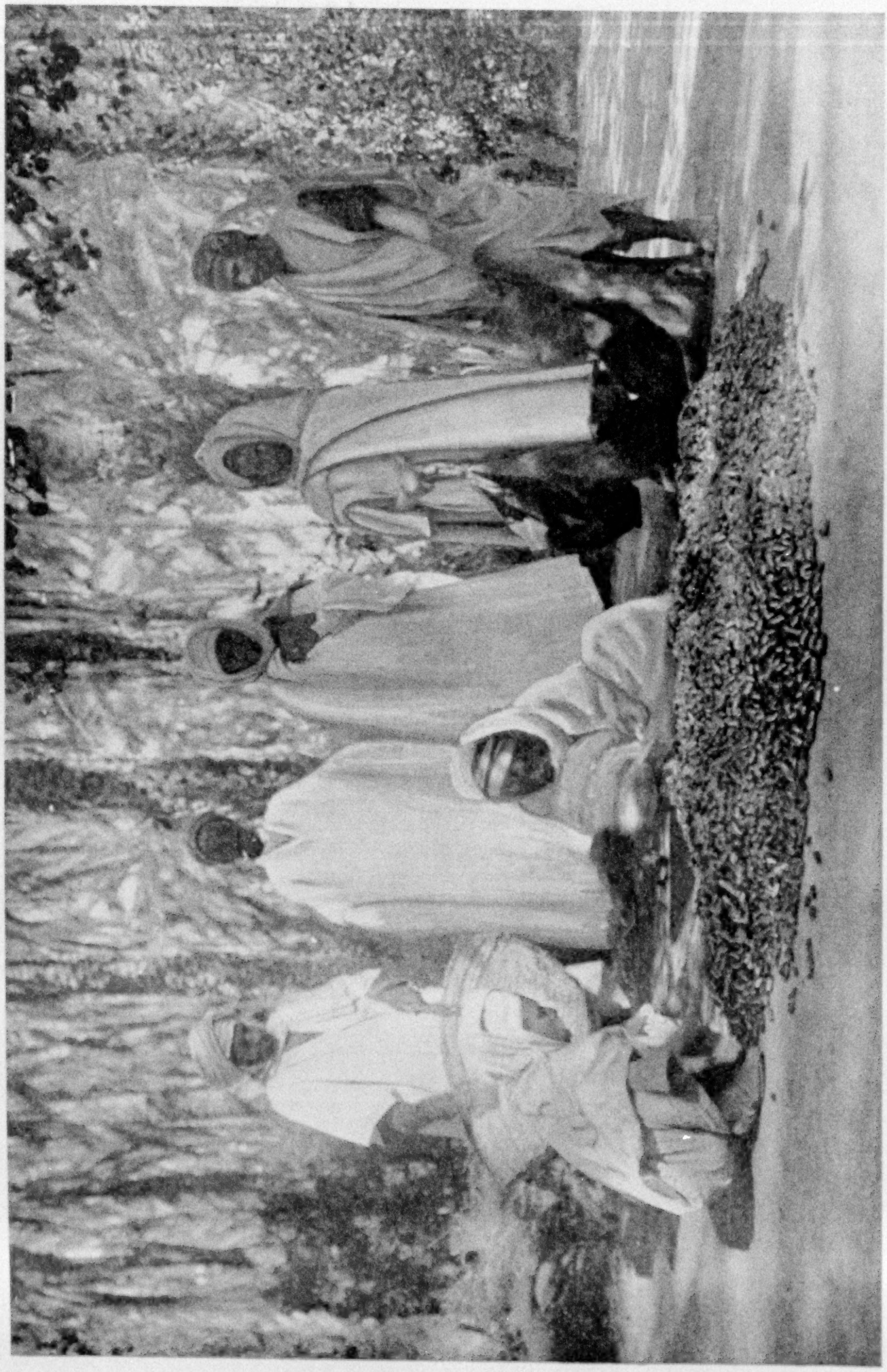
Several weeks were spent in getting together the collection of palms, for the rarer sorts had to be sought far and wide. Of certain varieties but a single offshoot could be had in any one oasis. Only a few of the most popular kinds are found in some of the orchards, while others are veritable botanical gardens, containing a tree or two of almost every variety known in that part of the Sahara. Such is the celebrated garden at Nefta that once belonged to the sovereigns of Tunis.

A special quest was made for the Menakher, the royal date which was formerly reserved for the table of the Beys. But, after ransacking the Jerid, only nine plants could be obtained. One of these was a present from Si Brahim ben Mohamed el Ouadi ben Ouidi, a magnate of Nefta. After infinite coaxing, the great man came one morning, with the carefully wrapped offshoot in his arms, holding it as tenderly as though it were an infant in brown swaddling clothes. But even then the honor of presenting to the American Government a date palm of this rare variety had to be painted in the most glowing language my interpreter could command before Si Brahim was persuaded to part with his treasure.

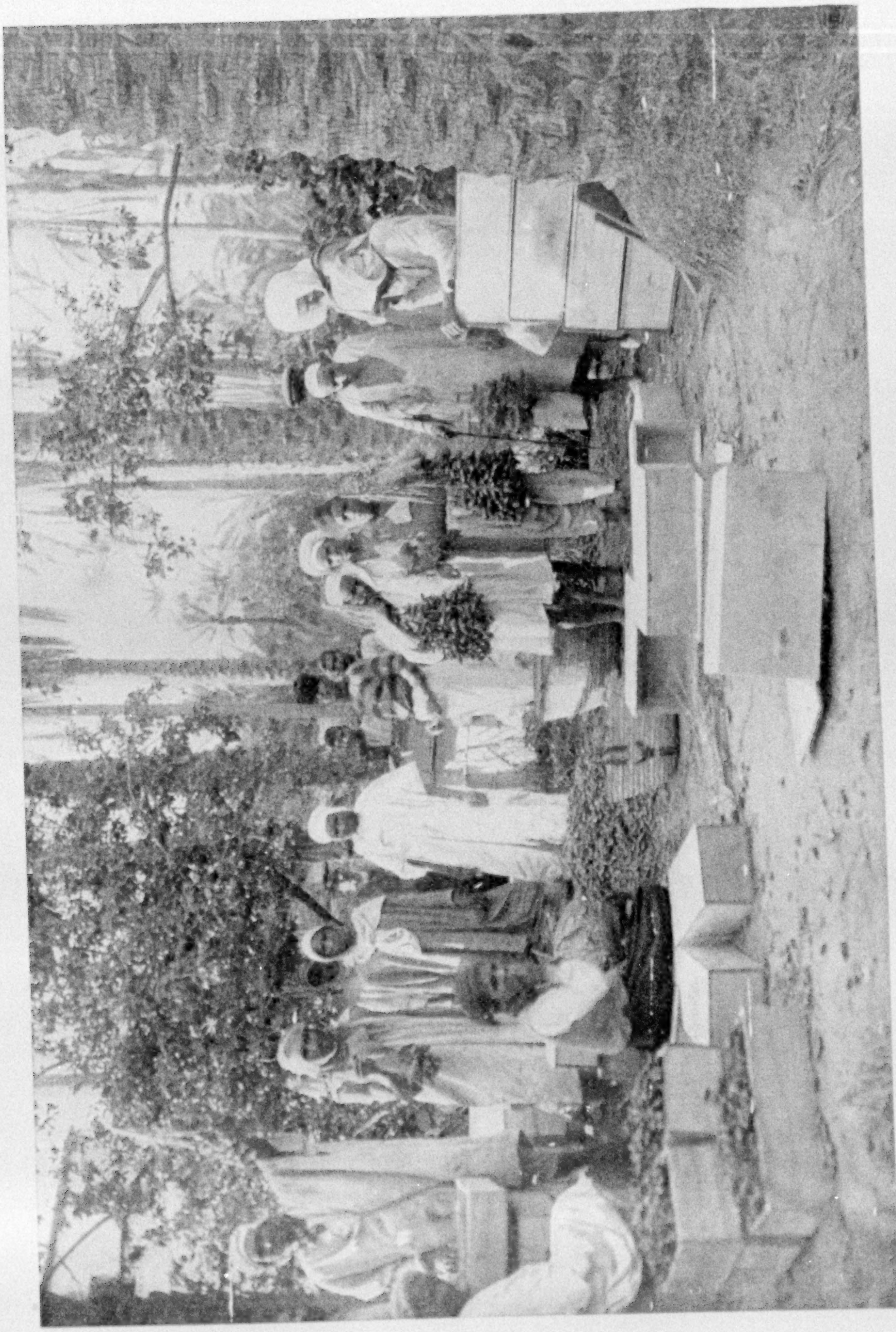


An expert workman, known as the "getaa," armed with a "mengel," an iron knife having a heavy serrated blade, with which he cuts off the bunch of ripe dates (see page 549)

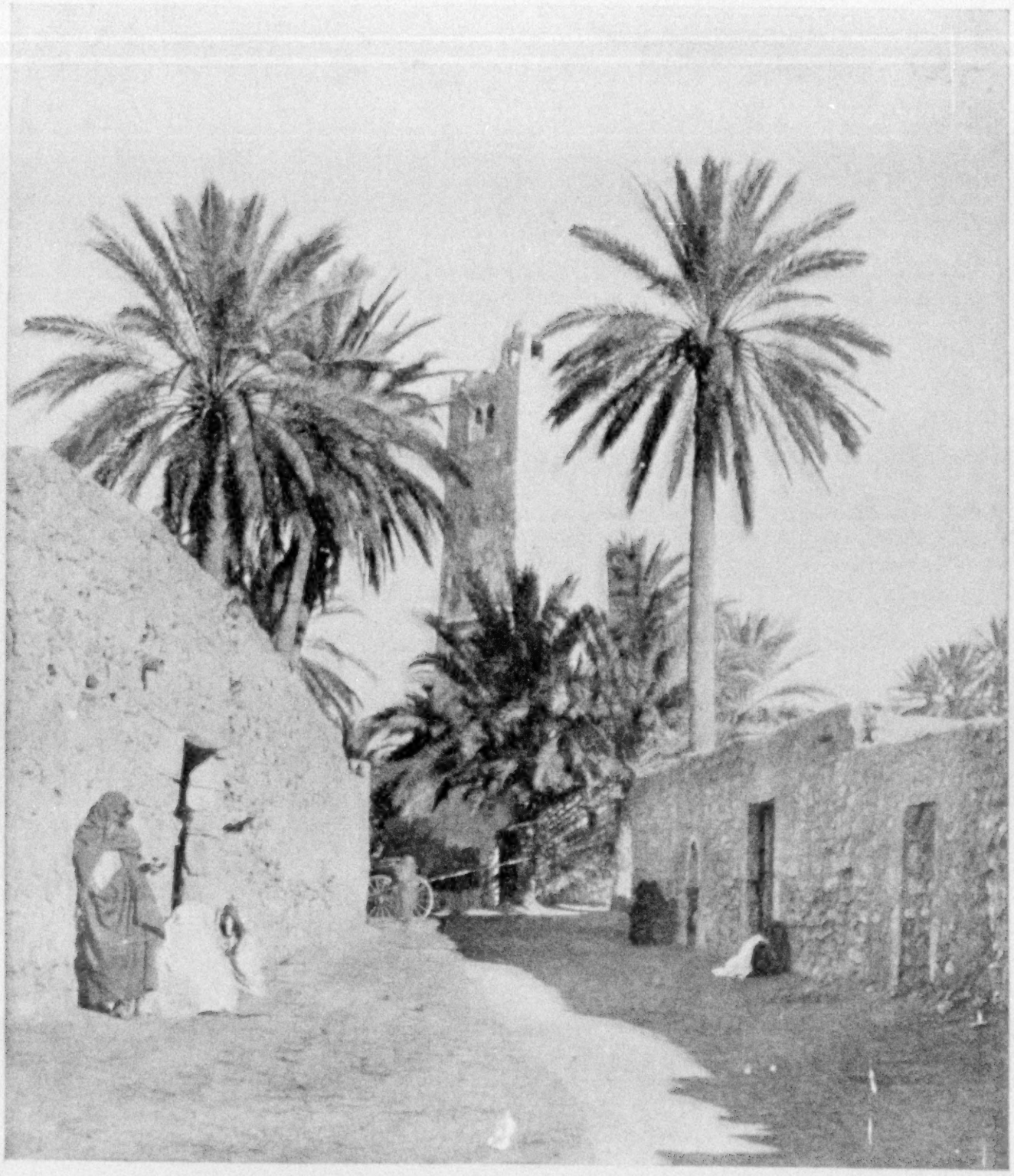
The entire collection, some eight hundred offshoots, was at last ready for shipment. Four score camels were needed to convey the palms across the desert to the railway. With the drivers, many of whom were followed by their wives and children, it was a rather imposing caravan that assembled one morning at Tozer. Ten additional camels were to join the main body when it should reach El Hamma. Meanwhile a cold north wind sprang up, filling the air with dust and sand. Late in the evening came word that the El Hamma contingent refused to set forth in the face of the storm. This was unwelcome news, for



The ordinary sorts of dates are exchanged for wheat and barley which the nomads of the high central plateaus bring down to the oases in the fall (see page 549)



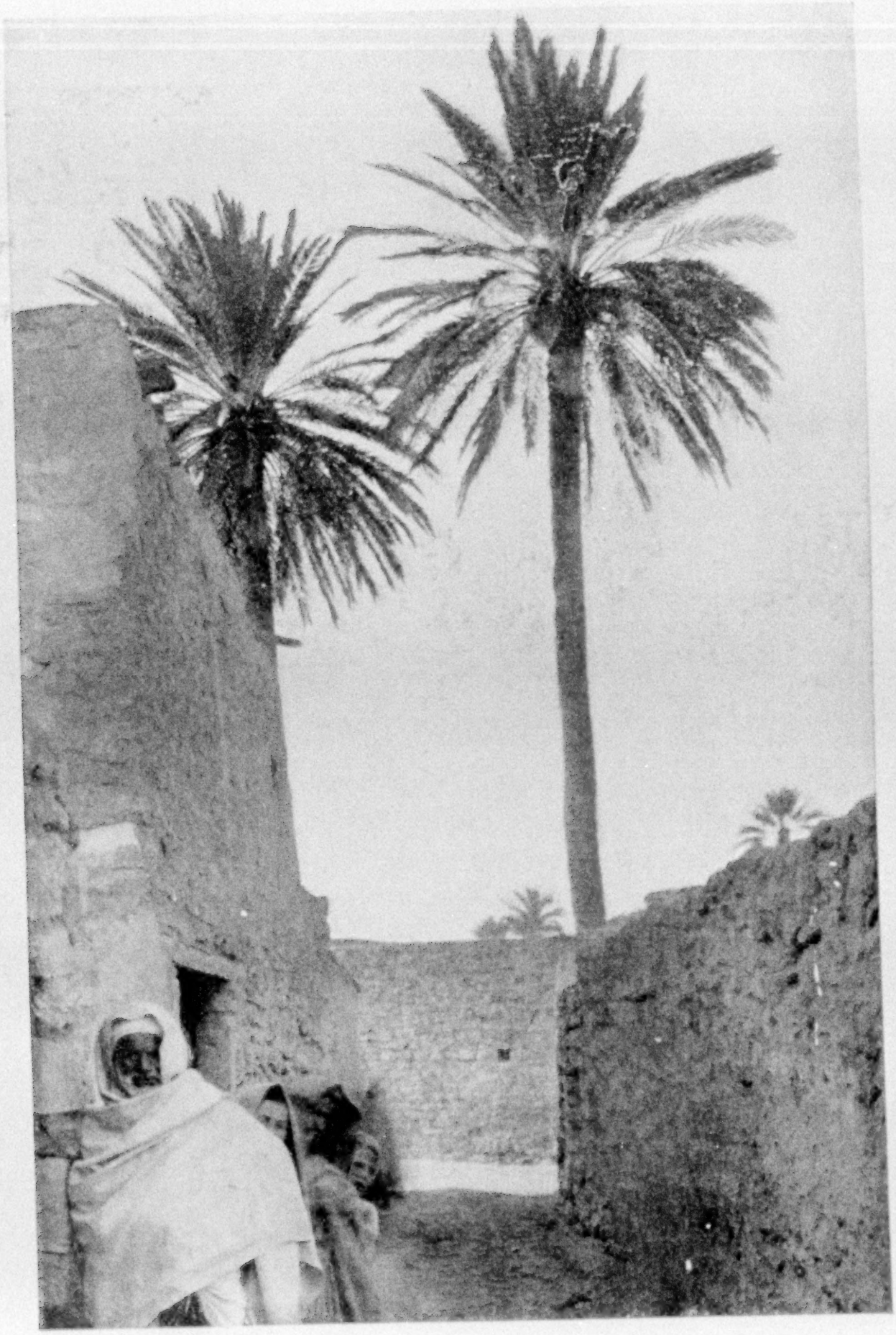
PACKING THE DATES FOR SHIPMENT: ALL THE BEST DATES ARE EXPORTED



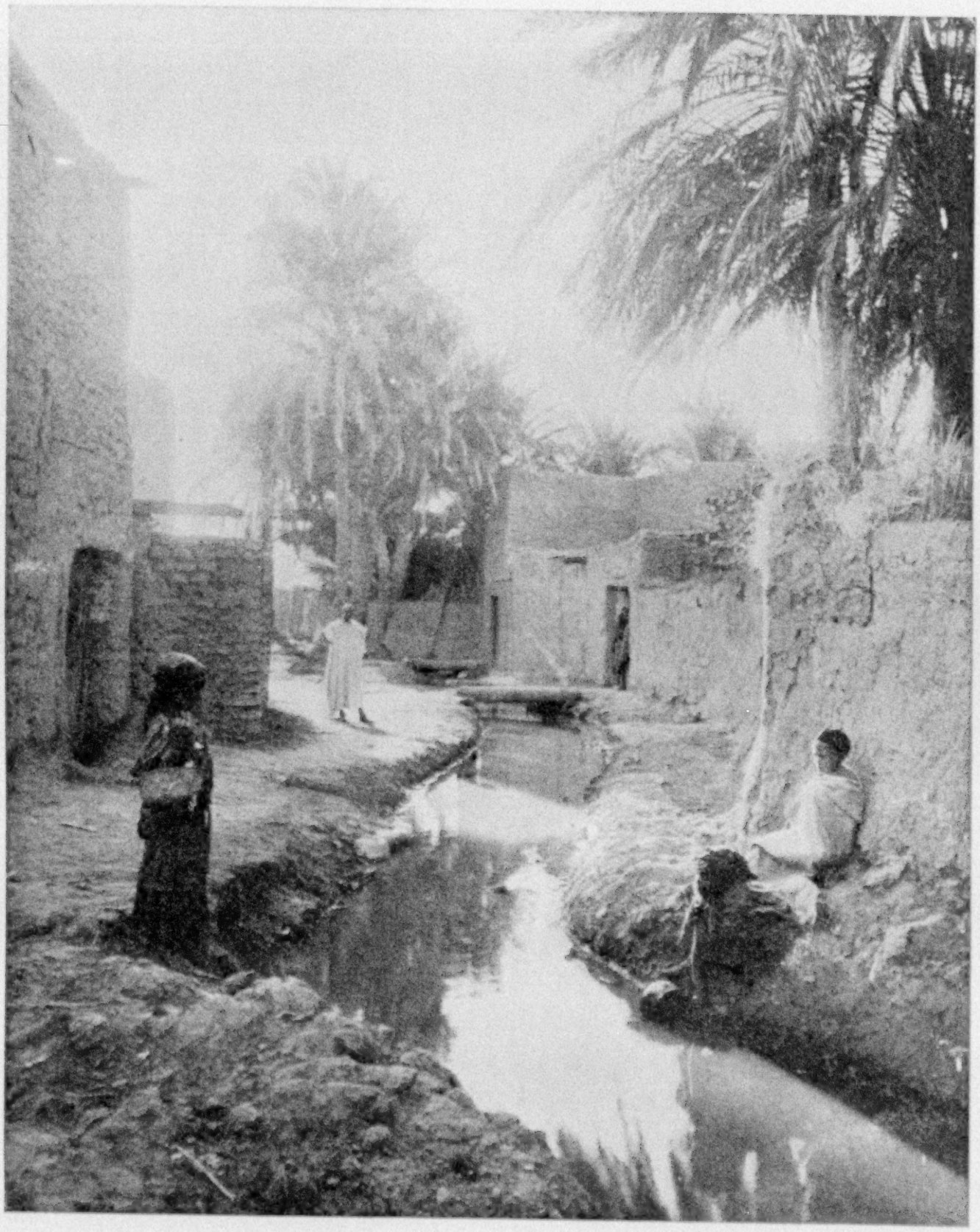
THE TALL MINARET OF THE MOSQUE IN AN OASIS TOWN

arrangements had been made to ship the palms by a steamer that was due to sail from Sfax within a few days. In this emergency I consulted the Caid of Tozer, the principal native official of the Jerid. He took prompt and decisive action, at once despatching a spahi with imperative orders to the refractory camel drivers to proceed without delay.

When I reached El Hamma early the following morning, I learned that this emissary had tried first persuasion, then threats, and at length had resorted to blows. A sound drubbing convinced the recalcitrants that the weather was not sufficiently inclement to prevent traveling, and at midnight they departed. I soon overtook them and found them



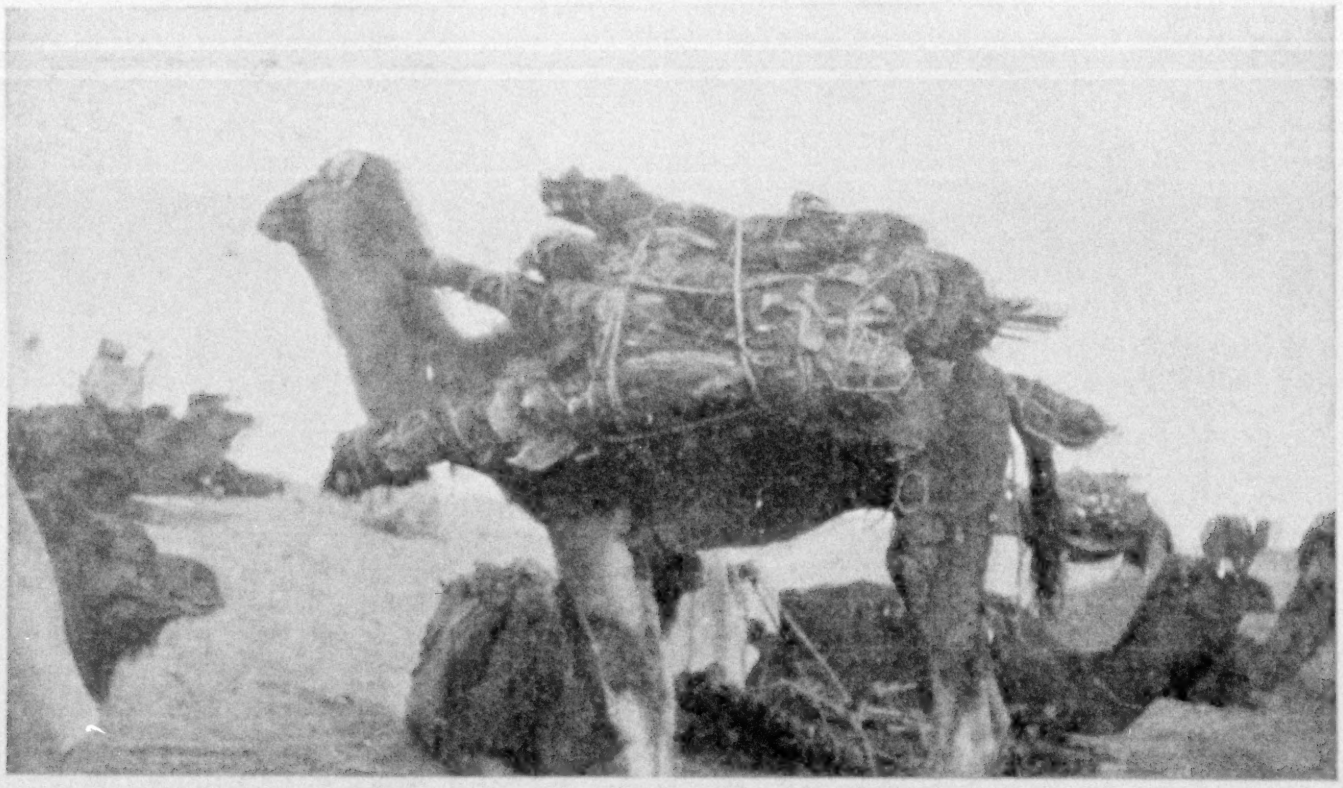
By the middle of the afternoon the people would be faint with hunger and huddled in silent groups at the edge of the town, watching the sun (see page 557)



SCENE IN AN OASIS TOWN Photo from Bishop J. C. Hartzell

Photo from Bishop J. C. Hartzell

CHILDREN OF THE DATE GARDENS



CAMEL WITH LOAD OF DATE OFFSHOOTS PRESENTED BY THE PEOPLE OF THE OASES TO THE UNITED STATES GOVERNMENT

It required 90 camels to carry all the offshoots across the desert to the railway

marching along dejectedly, for not only were their shoulders still aching from the beating of the night before, but they would have to pay a fine of one franc for each kilometer traveled by the spahi who administered the punishment. Such, El Hachemi assured me, was the law of the country.

At noon I came up with the main caravan, which was traveling in very open order. The camels were walking side by side and browsing as they went, while the drivers plodded afoot through the sand. The sheik or leader was a tall, well-set-up Soudanese, with skin as black as ebony. But most of the drivers were natives of the Souf oases, who have almost a monopoly of this vocation in the Algerian and Tunisian Sahara. Their sturdy limbs and dark, smiling faces offer a striking contrast to the lank forms and sullen, anæmic visages of the stay-at-home residents of the Jerid.

When the sun dipped below the horizon that afternoon the last camel had been unloaded at Metlaoui, and the palms were stowed away in the freight cars that waited to carry them to the coast. The drivers from El Hamma, who had made remarkable speed at the last, went away rejoicing when they learned that their fine would be remitted. A few days afterward I had the pleasure of watching the good ship Tafna as she steamed out of the harbor of Sfax with the cargo of date offshoots snugly reposing under tarpaulins on her deck.

Ten weeks passed by, and the little trees reached their journey's end in the new oases of the American Sahara. They were soon safe in the ground, alongside their cousins from the banks of the Nile and from Muscat and far-away Bagdad.

With the blazing sky of the desert once more above them and the life-giving water about their feet, they are growing and ripening their fruits as if there were no 8,000 miles of land and sea between them and the mother palms of the Jerid.

GATHERING THE DATE HARVEST

Photo by F. Soler

The top man hands the heavy cluster to his fellow just beneath, by whom it is passed from hand to hand until it reaches the ground. Note the oranges growing under the palms

CARRYING WATER THROUGH A DESERT

The Story of the Los Angeles Aqueduct

By Burt A. Heinly

GOD sowed the Mojave from an almost empty hand, they say, and so perhaps He did. For a few weeks of early spring this desert blooms as a paradise, but the blossoms bring no fruits. Quickly the broad acreage of flowers relapses into the sullenness of mile on mile of yellow sand, scorched day after day from the heat of a glaring sun. The rattlesnake finds protection in the narrow shade of the sage brush. With the exception of the lizard, other creeping things seek their holes and come forth after dark. Death Valley lies within Mojave's depths, while the western confines are bounded by the Sierra, into whose canyons run windrows of sand like fingers groping in the dark.

It is almost paradoxical that one of the most Titanic struggles ever undertaken by a municipality is being carried on within this desert waste, and the struggle is one for water.

At the northern outpost of the Mojave's sands a river, after gathering the drainage of the snow-clad Sierra for more than 150 miles, flows into an alkaline sink and wastes its fatness in evaporation from the sun's heat. One hundred and fifty miles across the Mojave, straight southward as the crow flies, rises the mountain wall of the Coast Range. Beyond lie foothills undulating into valleys, and a broad coastal plain on which nestle nearly 100 communities about the central metropolis of Los Angeles.

It is the plan of Los Angeles to carry the waters of this river and its tributary streams 250 miles southward across the Mojave Desert, beneath the Coast Range, and into the San Fernando Valley, where the precious fluid will be used to quench a city's thirst, to irrigate thousands of acres of rich soil now non-productive for want of moisture, to develop electrical energy to light her buildings and her streets, and furnish power for manufacturing industry on a scale new to the Pacific Coast.

The enterprise is now in the third year of its accomplishment, and will require from two and one-half to three more years for its completion. Five thousand men working through the blinding heat of the summer day and the blessed coolness of the desert night could tell the story better than pen can write.

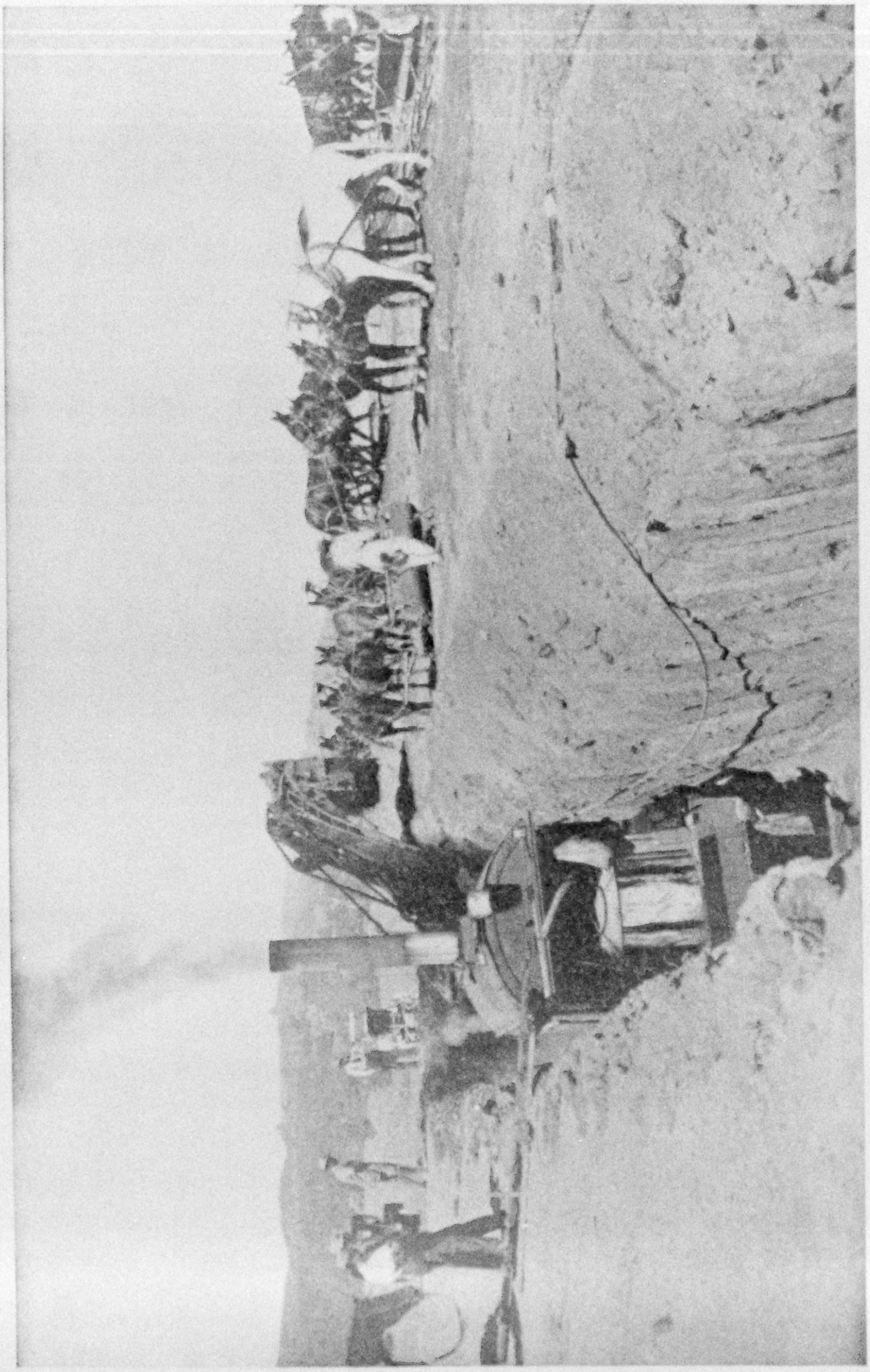
THE CITY DOES ALL THE WORK WITH ITS OWN WORKMEN

Mr John R. Freeman, the eminent hydraulic engineer, who is known for his connection with the Panama Canal and the New York Aqueduct, in describing the features of the project to a body of Boston engineers recently, classed the Los Angeles Aqueduct as the most interesting hydraulic construction now under way on the American continent. It is not the largest. The Panama Canal, the New York Aqueduct, and the Erie Barge Canal all outrival it in the order named, but in not one of these are to be found the features which make this project so spectacular in construction and so full of promise after completion.

The enterprise is not alone interesting because of the magnitude and the seemingly insurmountable difficulties being overcome, but it is remarkable because it is a public work which has been built at much greater speed than was promised and with less money than it was stated would be required. The city is doing the building with its own workmen and with its own engineers, one small contract excepted.

Only in the arid West does one come to a full realization of the value of a drop of water. Here it becomes the pearl without price. In a land where the rains fall with the first days of November

TWO CATERPILLAR TRACTION ENGINES COUPLED TOGETHER AND HAULING ONE OF THE BIG POWER-SHOVELS INTO THE DESERT, WHERE IT IS TO BE PLACED AT TRENCH EXCAVATION



A STEAM SHOVEL AT WORK DIGGING THE CONDUIT THROUGH THE DESERT

and cease with the coming of April, not to descend again until the approach of another winter, the truth of this saying is appreciated. Los Angeles lies in the heart of such a land, where through the long summer growing things usually mark moisture artificially applied.

Five years ago, when the city stood face to face with the grave problem of a steadily decreasing water supply and a rapidly increasing population, Owens Valley, the cleft in the Sierra from which the waters are to be taken, was almost unknown. Today even the children of the public schools have familiarized the location and characteristics.

The valley is a narrow one. Seven miles will span it at almost any point. To the eastward are the brown Inyos, to the westward the white Sierra. This latter range of mountains forms the roof-shed of the United States. Mount Whitney, snow-clad monarch of them all, rises to a height of 14,502 feet. Twenty-three other peaks exceed 13,500 feet in elevation. Along the Sierra the snows lie deep throughout the year. From the base 35 streams debouch and pour into Owens River from a drainage of 2,800 square miles.

Since the time when the land was new this river has spent its volume in alkaline Owens Lake, which has an approximate area of 75 square miles. Without an outlet, the very high evaporation of 90 inches each year has kept the lake at about the present size. Some water from the river has been used for irrigation in the valley, but by far the larger part has done service for no man.

To insure a water free from alkali, Los Angeles has gone 35 miles above the mouth of the river to build the intake of the aqueduct, and the supply that the city will use in the future will be of almost half the mineral content that its citizens are now drinking. There are a few scattering settlements in the valley, but the rugged mountain chain which yearly sends down its floods offers scant encouragement to the settler. Moreover, the government has included the territory within a forest reserve, so that freedom from human contamination, apparently, is forever preserved.

SECURING THE LAND RIGHTS

The ranches which carried water rights were purchased for cash in hand. Land was cheap then in Owens Valley. Los Angeles bought 120 square miles for a little over $1,000,000, and did this so quietly by the use of water-works funds that speculators who follow a city in its enterprises like dust follows in the rear of an army were unaware of their opportunity until too late. Compare the expenditure for this item with the millions which New York city has paid to insure the pureness of its new supply.

So much for the prize for which Los Angeles paid little more than a million, and for which it is now expending $23,000,000 to bring within the city limits! Now to follow the sinuous course of aqueduct building, marked today by hundreds of tents and unpainted buildings strung out along the desert, or perched high on mountain sides, or hidden away in canyons.

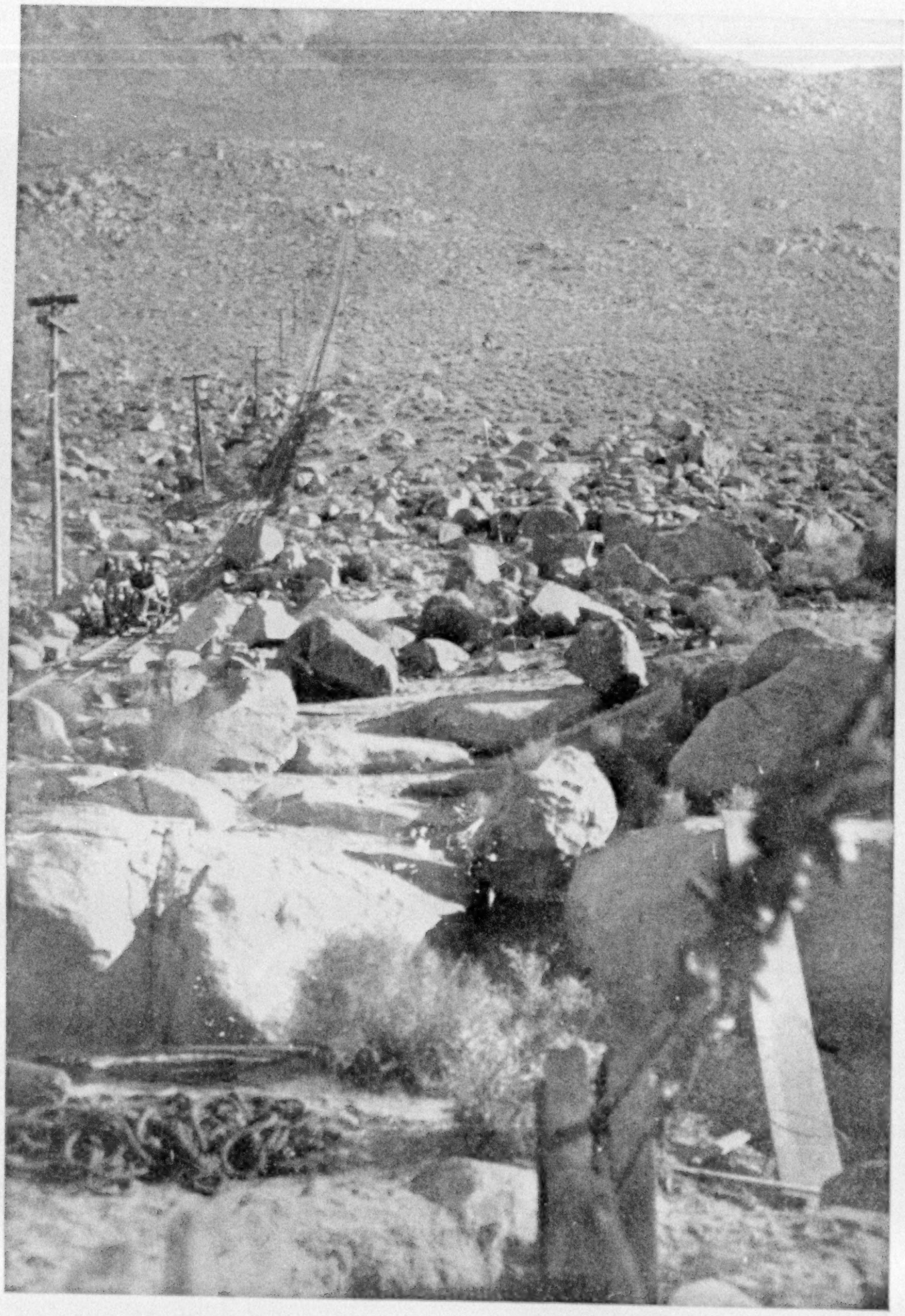
The big water-course is designed to deliver a daily supply of 260,000,000 gallons to the two storage reservoirs at its lower end.

The first 22 miles, from the intake to the toe of the Alabama foothills, is in canal 50 feet wide and 10 feet deep, uncemented and at a slightly higher elevation than the river. The excavation is here being done by three electric dredges working night and day, and with 8 miles completed April 1, 1910.

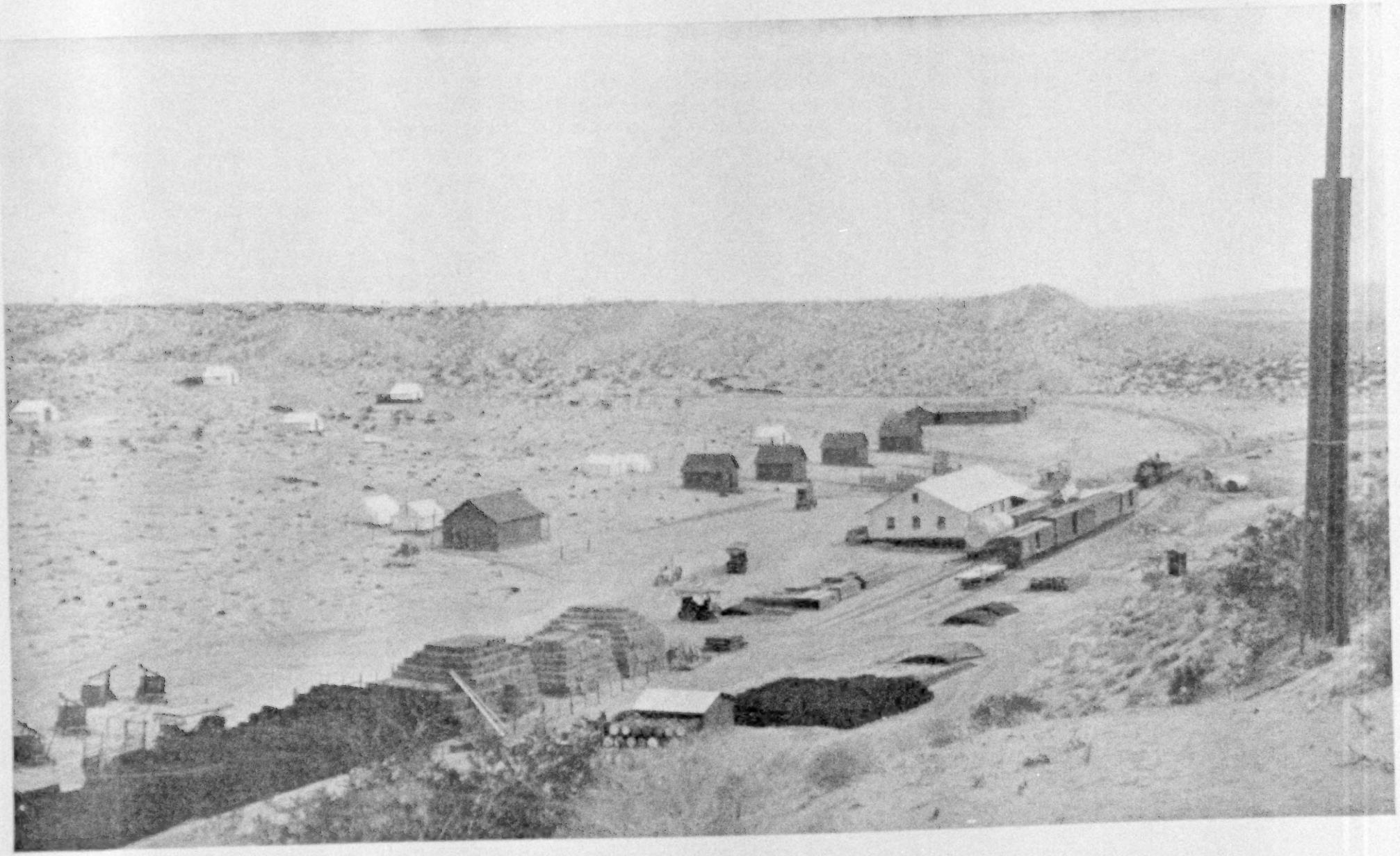
At the Alabama foothills we strike into the mountain side, where a concrete ditch 18 feet wide and 15 feet deep is being constructed. This will receive the flow of half a dozen good-sized mountain streams in addition to that of the river, and will carry the water, at an elevation of 200 feet above the surface of Owens Lake, a distance of 38 miles to the Haiwee reservoir.

THE STORE-HOUSE OF THE WATERS

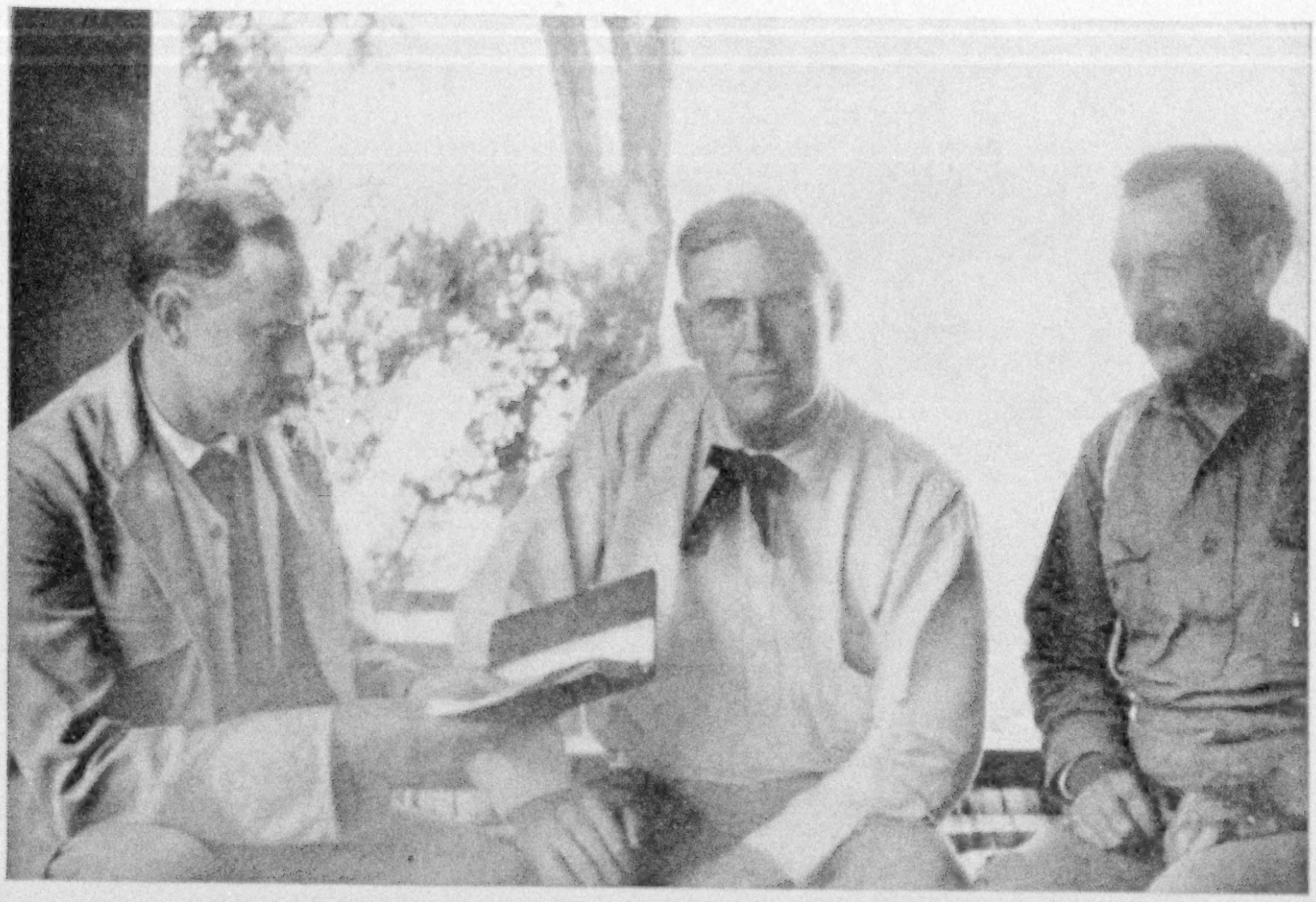
The Haiwee basin is the old course of the Owens River before the stream was



WHERE ROADS ARE NOT PRACTICAL, LOG RAILWAYS AND AERIAL TRAMS CARRY MEN AND MATERIALS TO THE POINT WHERE THE ENGINEERS HAVE LAID OUT THE COURSE OF THE AQUEDUCT



ONE OF THE MANY SMALL AQUEDUCT SUPPLY STATIONS IN THE HEART OF THE MOJAVE DESERT



J. B. Lippincott, Assistant Chief Engineer (with book); Hon. Fred Eaton (center), father of the Owens River project; William Mulholland (side), Chief Engineer

dammed into Owens Lake, and at a time when Mother Nature was making over the Western Hemisphere. When the hydraulic-filled dam is completed, the reservoir will have an area of 15 square miles, and will serve for storage, regulation, and clarification of the summer floods. Once full, if its supply were to be cut off entirely the storage capacity is sufficient for the needs of Los Angeles for more than three years.

From the Haiwee reservoir the water will be carried southward in a closed concrete conduit for a distance of 125 miles, following, as a rule, the contour of the country through which it passes. Sometimes the snaky thing of dirty white will lie along the surface of the desert; at other times it will rest in niches cut in rocky mountain walls; canyons it will descend on one side, then ascend the other as a large cylindrical metal shell nearly an inch in thickness; mountains which forbid ascent will be burrowed. When at length the northern base of the Coast Range has been reached the waters will be given rest in the Fairmont reservoir, but only temporarily.

HOW THE WATER WILL BE RELAYED

From the bottom of the basin, which is one for regulation, the water will pass 26,860 feet through a tunnel under the Coast Range to come out on the edge of San Francisquito canyon; thence for 11 miles through conduit and tunnel to be shot down 800 feet upon the restless wheels of two large hydro-electric plants; thence for 7 miles and another sheer descent of 700 feet to develop more electric power; then on again 16 miles to a third power plant, finally to find freedom in the San Fernando reservoirs.

These two basins perched on the rim of the San Fernando Valley will look down 1,000 feet upon Los Angeles, 20 miles away, and a score of other towns and cities of the Pacific coastal plain. No pumping is anywhere necessary. The only expense will be that of maintenance, which should be small because of the enduring character of the materials em-

BUILDING THE GRAY RIDGE ROAD IN THE JAWBONE DIVISION

Eight miles were cut out of solid rock. The background gives an idea of the boldness and barrenness of the mountains in the Jawbone Division of the aqueduct

ployed in the construction. From the intake, at an elevation of 3,800 feet, the water of its own gravity will flow with gentle velocity, excepting at points where power is developed, to the impounding basins at the lower end, and will there be drawn off as needed for irrigation and domestic use.

The size and the shape of the conduit south from the Haiwee reservoir vary greatly. Both are determined by the character of the country and the soil formation. The average size of the excavation now being made is 12 feet wide and 10 feet deep.

With the exception of the 22 miles of unlined canal and the 38 miles of lined conduit which empties into the Haiwee reservoir, the aqueduct is being covered. The lining of concrete for the conduit ranges from 8 to 12 inches. The concrete slabs moulded into a covering have a thickness of 6 inches and are reinforced with steel.

There are 22 miles of canal, 43 miles of tunnels, 15 miles of steel siphons and concrete flumes, and 137 miles of concrete-covered conduit, with 13 miles of the remaining distance made up by reservoir distance. This makes a total of 230 miles from the point of intake to the lower outlet. Thence the water required for domestic consumption will be carried 20 miles in a riveted steel supply main, which will empty into the reservoirs of the city's present distribution system.

This is the Los Angeles Aqueduct. The major portion of the most difficult and expensive part of the work is finished. In point of difficulty 68 per cent of the aqueduct and 46 per cent in distance is completed.

THE GROUNDWORK OF THE PROJECT

Let us go back five years and with the first party of engineers examine the bare expanse across which they were expected to search out the cheapest and most feasible route. There was then a rambling trail that led out of Mojave on the Southern Pacific north to Keeler on the shores of Owens Lake and the terminal of the Carson and Colorado narrow gauge. The path was dug into the desert more than 40 years ago by the wheels of "Remi" Nadeau's 20-mule freighters, which carried the rich silver ore of the Sierra Gordo mine to the port of San Pedro at the rate of four cents a pound. Wind and sand and cloudburst in the mountains have changed it somewhat with the years, but Vasquez and his gentlemen of the road, were they alive today, could still pick out the points of vantage where they gave unwelcome greeting to travelers of the trail.

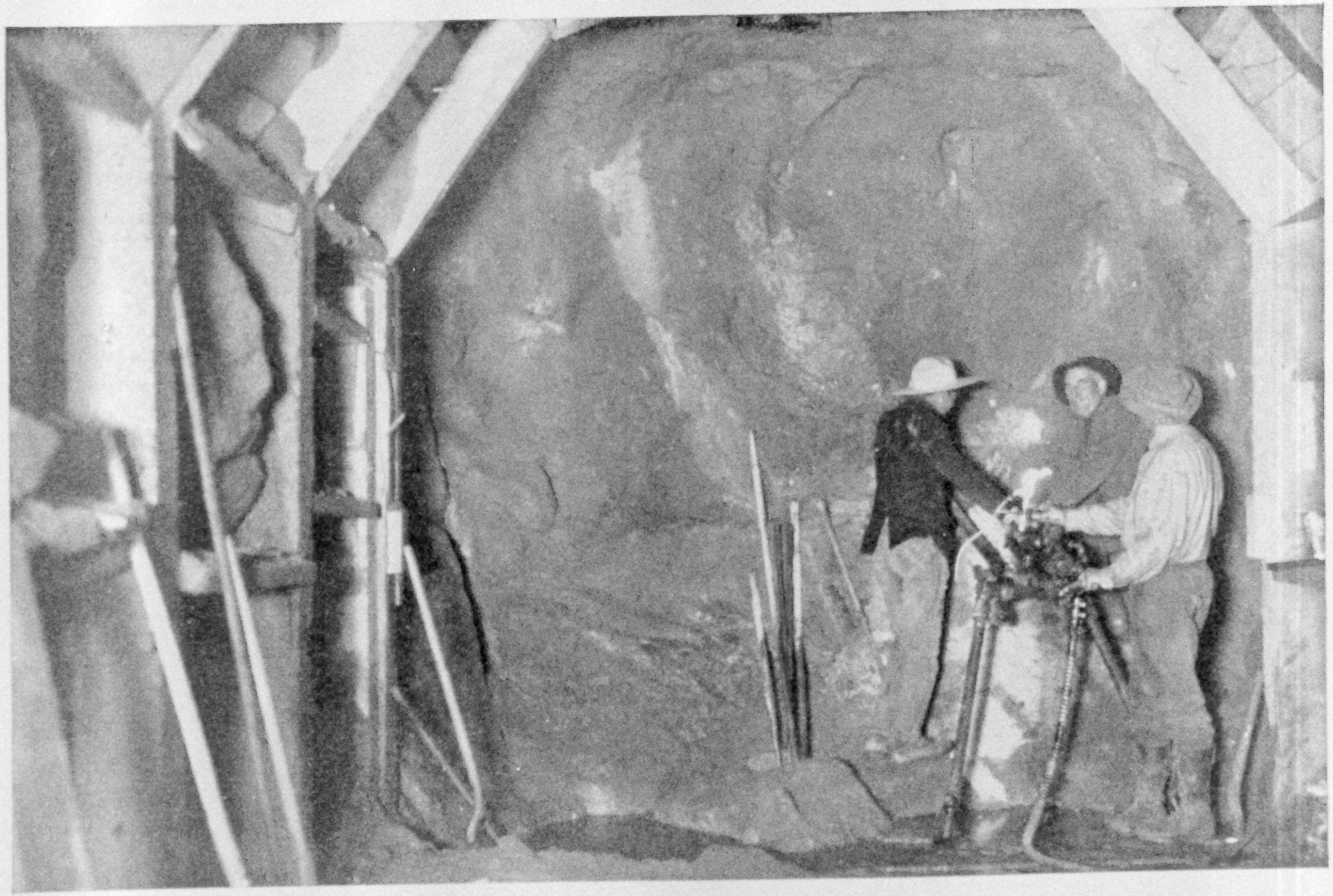
For four decades and until 1909 a stage coach, vestige of the days of '49, made tri-weekly journeys as the only method of communication and transportation between Mojave and Keeler, stopping at seven points for change of horses. These seven points mark as many waterholes. You will not find the precious fluid elsewhere along the path. Had you not the wherewithal to ride, and had the trace of wheels been blotted out, you could have still guided your steps by empty bottles. It is a dry land and brings thirst quickly.

At times even fuel with which to cook—and fuel was sage brush—became a rarity for these engineers. One party followed another until there were more than 200 men in the field. With laborious effort they marked their progress with a line of stakes set 50 feet apart, sometimes in places where a human foot had never trod nor cared to tread. They found little or no water, no fuel for the development of power, no railroads to carry materials, men, and subsistence, and for 100 miles within the zone of the aqueduct not even trails.

The $23,000,000 bond issue was voted June 13, 1907. Immediately the portion of the plans of these engineers that called not for aqueduct excavation, but for overcoming obstacles by which aqueduct construction might be accomplished, began to materialize.

A FEW OF THE DIFFICULTIES OVERCOME

They built 225 miles of road and trail, one notable example in the Jawbone Division being hewn for 8 miles in solid



IN THE SOUTH PORTAL OF THE ELIZABETH TUNNEL, WHICH IS NEARLY FIVE MILES LONG (26,860 FEET), AND PASSES UNDER THE COAST RANGE

Miners at work on the face with Leyner drills, in 13,000 feet

THE MUNICIPAL CEMENT MILL, WITH CLAY BEDS AND LIMESTONE QUARRIES, COSTING $750,000

rock at a total cost of more than $40,000. They laid 180 miles of water mains from springs far back in the mountains to the line of the aqueduct. These systems are four in number, and with reservoirs at high elevations insure a copious supply of pure water for domestic use and for the mixing of concrete. They staked the course of a standard gauge steam railroad 125 miles in length with the expectation that the city would construct, own, and operate the line. The Southern Pacific stepped in, however, and in return for the handling of the 1,000,000 tons of aqueduct freight took the transportation problem off the city's hands. The new road is completed today from Mojave to Owens Lake, and by fall will be in operation to the mouth of the Owens Valley. The railroad parallels the aqueduct as far as this is feasible.

Materials and supplies are stored in warehouses along the tracks and thence are trucked by mule-team freighters or caterpillar traction engines to the places where they are required. For long stretches the aqueduct lies at an elevation of 1,200 feet above the desert, and at points where road construction is not feasible aerial cables serve as carriers.

With the questions of water supply and transportation out of the way, there yet remained the problems of communication and of power for the mechanical equipment. The difficulty in the first instance was disposed of by the building of a copper wire telephone system from the headquarters in Los Angeles to the intake, 250 miles north. From the main line branches ramify into each of the 100 or more camps, so that the chief is always in touch with his engineers.

The energy of two mountain streams have been utilized to furnish power. Three hydro-electric power plants generating a total of 3,300 horse-power have been erected, and the electric fluid is carried over high-resistance transmission wires as far southward as Mojave. By this means the three dredges are driven, many of the power shovels, all the tunnel equipment, half a dozen machine shops, and a cement mill, not to mention the lighting of all the camps. The expense has amounted to one cent per horse-power per hour. To have employed steam at the high cost of fuel, not to consider the scarcity of water, would have cost ten times this amount.

The sandy waste that for centuries has felt only the light tread of the skulking coyote today crunches under the wheels of heavily laden lumber freighters, and canyons that had heard only the wailing cry of the mountain lion resound with the tattoo of hundreds of hammers. The sometime path of the aqueduct through the silent desert became a scene of transformation. Barns, warehouses, laborers' quarters, mess-halls, power-houses, and hospitals went up as if by magic. Where there was immediate need, white tents arose over night like mushrooms in a pasture after an April rain. Eight months saw 500 wooden structures erected and 600 temporary canvas shelters.

THE CITY MANUFACTURING ITS OWN MATERIAL

In the estimate of materials required, 1,200,000 barrels of cement was the principal item. Cement is a mixture of limestone and certain clays rightfully proportioned, burned, and ground to an impalpable powder. Mixed with sand and gravel and water, it forms a concrete that, after being allowed to set, has the hardness of rock.

Almost midway between the intake and the outlet of the big watercourse, and on the main line of the Southern Pacific Railroad, the city's engineers discovered excellent deposits for the manufacture of cement.

No city previous to this time had entered into the cement-making business, but Los Angeles, undeterred, purchased the lands and began the erection of a plant. Los Angeles today owns the village of Monolith, is the sole employer of the 250 laborers and skilled artisans dwelling therein with their families, and every 24 hours ships out along the aqueduct more than 1,000 barrels of cement. Even at this rate the mill cannot keep pace with the unprecedented speed of

PLACING THE FORMS, TO BE FOLLOWED BY THE POURING OF CONCRETE

BUILDING THE AQUEDUCT IN A NICHE CUT HIGH ALONG THE MOUNTAIN'S FACE
The steep pitch of the land is shown in upper half of photo

building, and recourse is also had to corporation mills.

In two localities within the aqueduct zone deposits of tufa or volcanic ash have been discovered, and grinding plants have been erected at both points. The product is mixed with the Monolith cement to form a mixture stronger but closely similar to the material used by the Romans in the construction of their aqueducts 2,000 years ago, and which are doing service to this day.

While this preliminary construction was in progress 18 months rolled around. In December, 1908, the Los Angeles Chamber of Commerce called upon the chief engineer to give a statement of how much of the aqueduct had been completed to that date.

Mr Mulholland met the committee of this body with some trepidation. It is human nature, whether in Maine or California, for taxpayers to demand results, and these immediately. "Well," he answered, "we have spent about $3,000,000 all told, I guess, and there is perhaps 900 feet of aqueduct built. Figuring all our expenditures, it has cost us about $3,300 per foot"—this defiantly. He waited for his words to sink in; then added, "But by this time next year I'll have 50 miles completed, and at a cost of under $30 per foot, if you'll let me alone."

"All right, Bill," said the chairman. (In Los Angeles, grown from a village to a metropolis in a decade, the residents still call each other by their first names.) "Go ahead; we're not mad about it."

THE RESULT OF CO-OPERATION AND CONFIDENCE

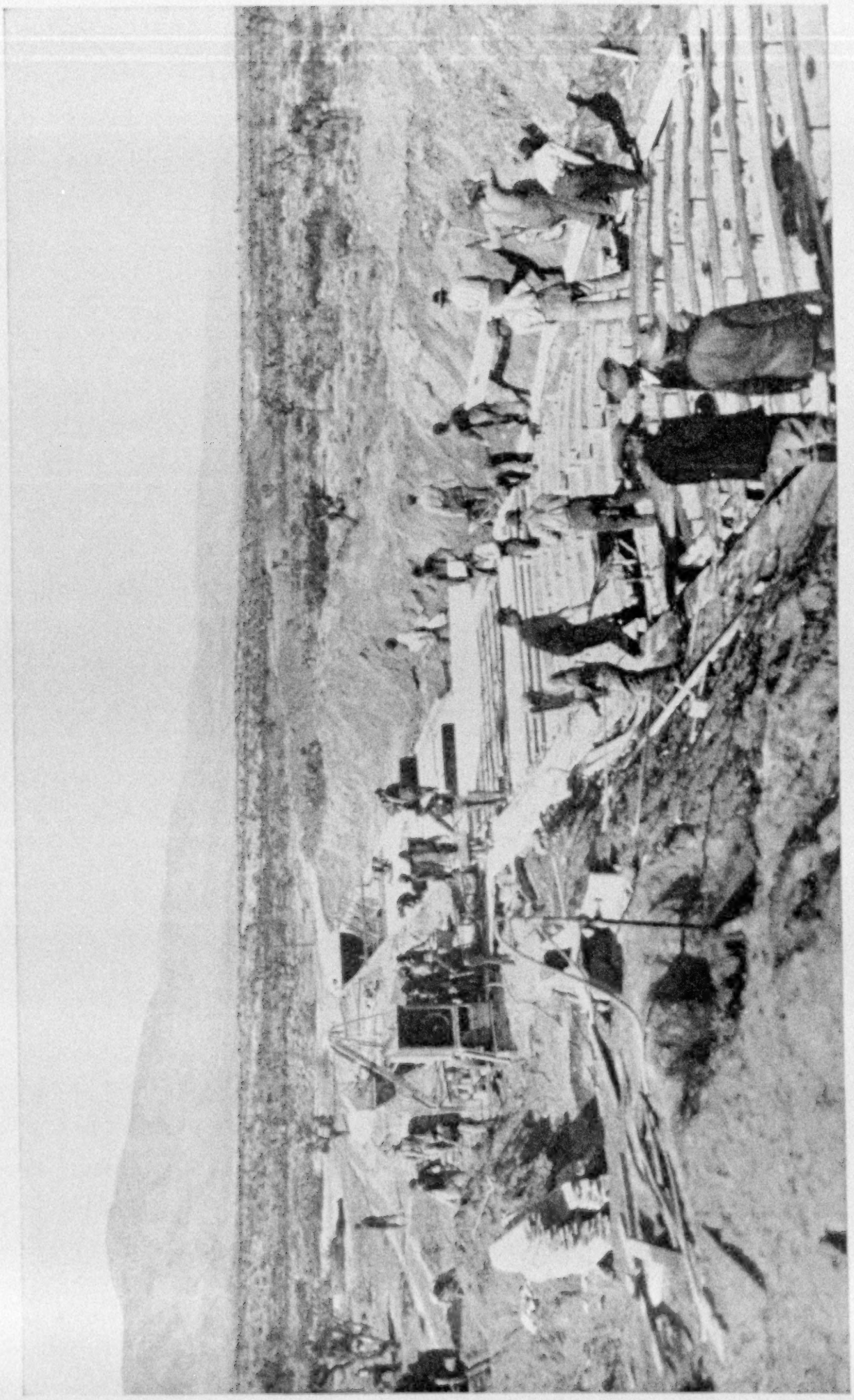
Herein is to be attributed no small part of the success of the undertaking. Mulholland has the confidence of the community. It believes in him implicitly, and he believes implicitly in the job and the men under him. "If Mulholland told these people he was building the aqueduct out of green cheese," said a newspaper reporter, "they'd not only believe but take oath that it was so."

The project is inseparably associated with the man and his life's work. He is now 54 years of age and is Irish by birth. At 20 he came to America. Two years later he landed in California with a fair education, a wonderfully retentive memory, ambition to improve himself, and $10 in his pocket as his capital. His first work was in digging artesian wells. Six months afterward he accepted a position as "zanjero," or ditch-cleaner, for the Los Angeles City Water Company. For three years he lived alone in a cabin far up in the Los Angeles River bottom. His days were passed in ditch-cleaning, his nights between sleep and study. Step by step he pulled himself upward. In 1882 he was made superintendent and chief engineer of the company. The impecunious policy of the corporation and an inability to keep pace with the growth of the city forced the municipality, in 1902, to take over the property.

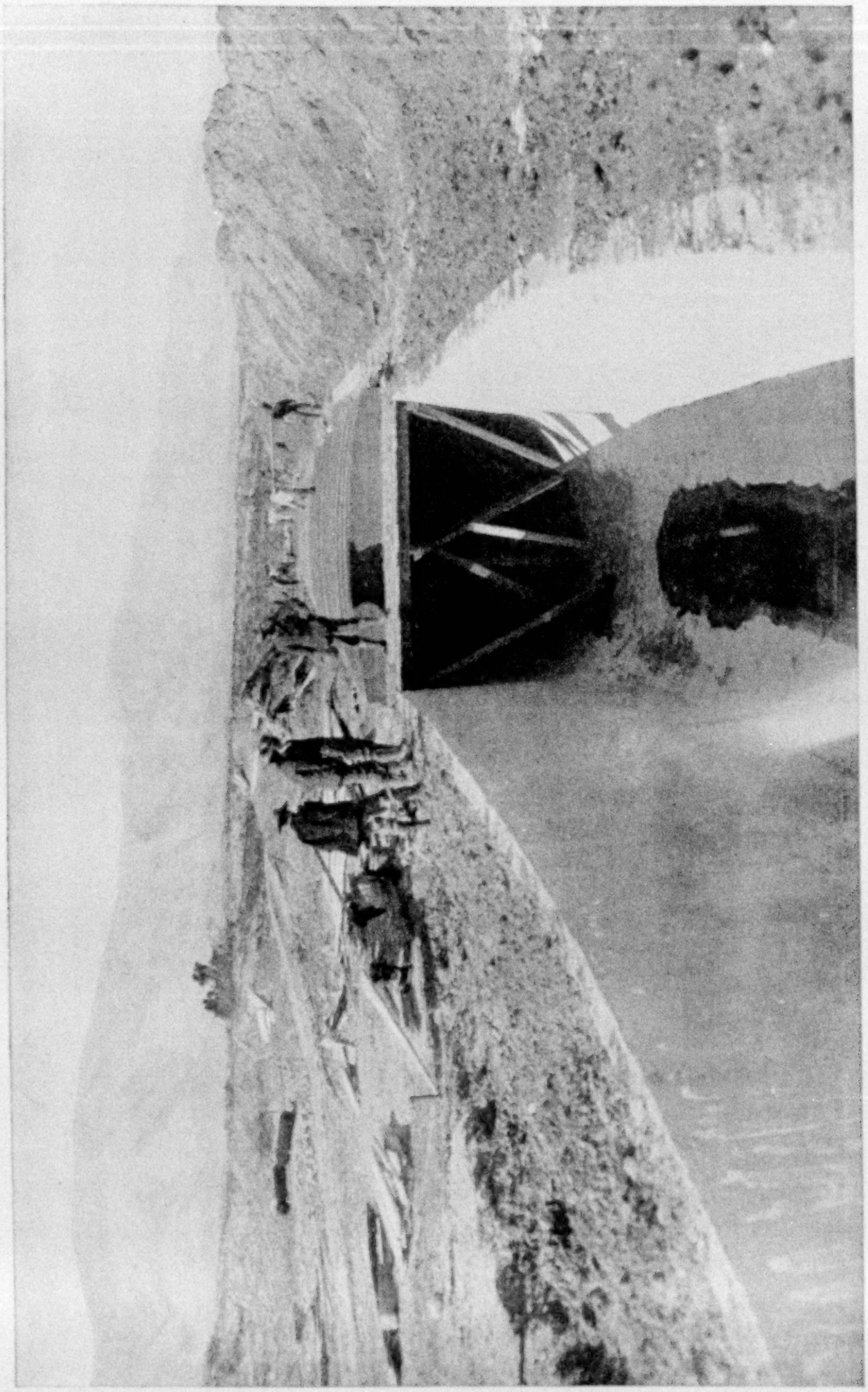
Mr Mulholland was retained in his position, and a non-political Board of Water Commissioners was placed in office. Under the supervision of Mr Mulholland and these men the enterprise prospered exceedingly. Today it is one of the three most successful water works in the United States.

No sooner was the water department upon a firm basis than Mr Mulholland set about to seek a source of supply larger than that of the Los Angeles River. Mr Fred Eaton, at one time superintendent of the City Water Company and later city engineer, then mayor of Los Angeles, had lived in the Owens Valley for 13 years. He felt confident that in this cleft in the Sierra lay the city's only hope. Mr Eaton prevailed upon Mr Mulholland to visit the valley with him, and he returned with the conviction that Mr Eaton had found what he himself had sought without avail. Neither the great distance nor the seemingly insurmountable obstacles could frighten him. He knew only that Los Angeles must have water to continue her existence as a city, and that the water must come from the Owens Valley, 250 miles in a straight line to the northward.

The Water Board purchased or took options on $1,000,000 worth of land and water rights solely upon his recommendation, the money being advanced from



PUTTING ON THE COVER OF THE AQUEDUCT IN THE MOJAVE DESERT



SHOWING OPEN CONDUIT AND THE COVER IN PLACE

the revenues of the water department, of which the board has the right of expenditure.

FINANCING THE PROPOSITION

In 1905 the people voted $1,500,000 in bonds to pay for these properties and carry on the preliminary engineering investigations. When his plans and estimates had been approved by a board of consulting engineers of national reputation, they voted $23,000,000 more to complete the project. This was the extent to which the people could bond themselves under their charter from the State, and was a tax of $88 upon every man, woman, and child within the corporate limits. They knew also that they would be called upon to vote upwards of $6,500,000 more bonds for the electric-power development as soon as the city, by its growth in taxable property, could legally do so.

Here, certainly, was not only an enduring faith in themselves, but a blind trustfulness in the man who had told them what they must have and how they could get it.

The faith was built largely upon the successful operation of the present water system, the known honesty of the public servants identified with the plant, and the absolute freedom from all politics which has been maintained in the water department since the city began the purveying of its water.

The confidence that has been given Mr Mulholland and his chief assistant, Mr J. B. Lippincott, formerly United States Government Reclamation Engineer for the Pacific Coast, they have passed on to the men whom they have assembled about them in the work.

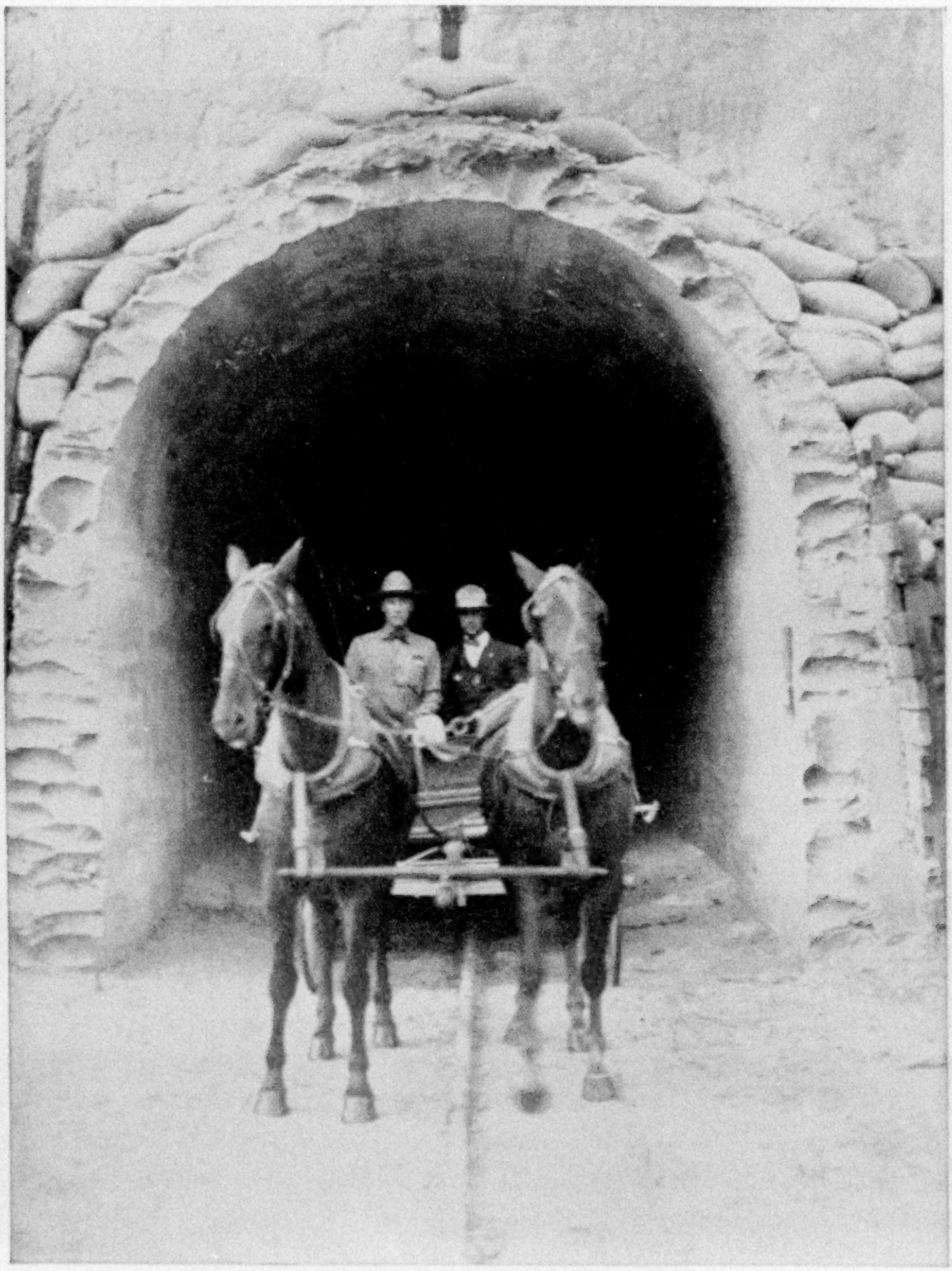
By the time the preliminary preparations for construction had been completed an efficient organization had been developed. The line of the aqueduct was apportioned into 11 divisions, the length ranging from 6 to 23 miles, depending upon the character of the construction. An assistant engineer was placed in charge of each of these and given large latitude in the management of its affairs.

THE QUESTION OF THE CONTRACTS

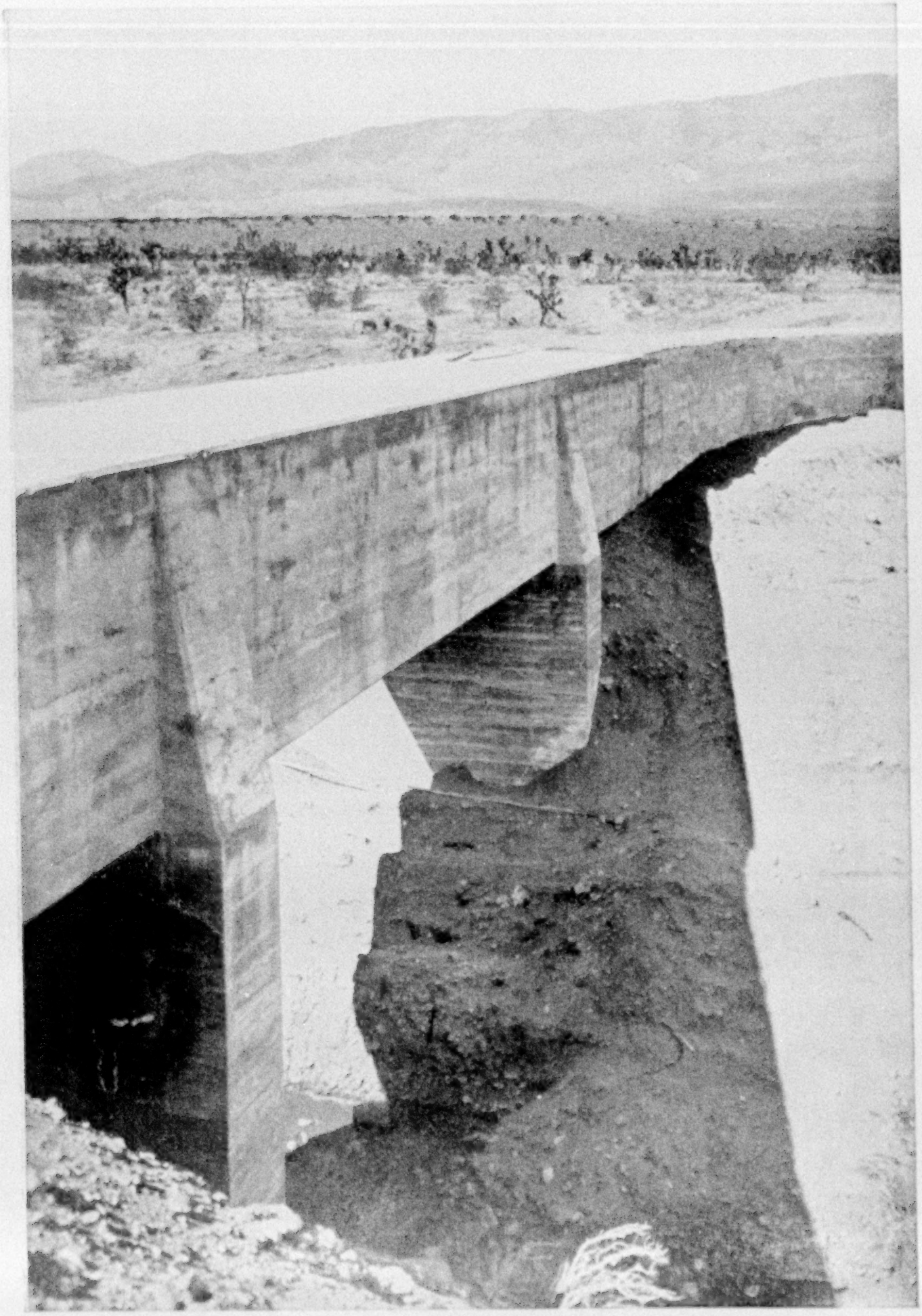
When the time came to determine whether the work should be done by contractors or under the direct supervision of the city, the aqueduct engineering force stood ready for the latter upon 30 days' notice. Mr Mulholland was anxious that the city should do its own work. He contended that this was what he and his assistants had been employed to do, but the Board of Public Works, which has the expenditure of bond moneys, was undecided.

Bids for the construction of the Jawbone Division, comprising 23 miles of the most difficult excavation, were advertised. The proposals ranged from 50 to 100 per cent higher than the estimates which had been prepared by the city's engineers. The board told Mr Mulholland to roll up his sleeves and pitch in. Three weeks after the command was given they were opening the first tunnel portals. This was in November, 1908. Just 12 months later a little over 50 miles of conduit, tunnel, and canal had been dug. In the Jawbone Division the cost was in many instances 50 per cent less than the figure demanded by contractors, and the entire 50 miles required an expenditure of between 10 and 12 per cent less than city engineers had estimated.

At the time the bonds were voted the promise was made that the enterprise would be finished in the summer of 1913. April 1 the Aqueduct Bureau, basing its estimates upon the work already accomplished and the daily rate of progress, stated emphatically that Owens River water would be delivered in Los Angeles by May 1, 1912, and at a cost less than the $23,000,000 which the people had provided. How much less they did not pretend to say, but there were intimations that it would be a round $2,000,000. However, June 1 the flurry in the money market caused the city's New York bankers temporarily to stop taking aqueduct bonds until some time in the fall. Construction was therefore immediately scaled to meet the new conditions, as the bureau at the time had little more than $800,000 on hand. A popular subscrip-



ONE OF THE AQUEDUCT TUNNELS



THE AQUEDUCT SPANS SMALL DESERT WASHES BY RECTANGULAR CONCRETE CULVERTS

tion for aqueduct bonds will be opened during July for the purpose of adding to this fund.

The loss of time, and, what is of greater hurt, the partial destruction of an organization wonderful in its efficiency, will extend the time of completion somewhat beyond May, 1912. Despite the temporary delay, due entirely to the unforeseen financial conditions, there is every reason to believe that the task will be accomplished well within the original time limit.

Six months after the opening of the Jawbone Division, the Board of Public Works let a small contract of 10 miles of easy conduit and tunnel section, because the board desired to be able to compare private and municipal efficiency, the result to guide them in the building of the remaining aqueduct mileage. The city, with the exception of this one contract, is doing all its own work.

Basing the cost upon contractors' bids for the completion of the Jawbone Division and the extras made necessary on the single contract, the aqueduct could not have been completed under $40,000,000. This statement is based upon the careful figures of the aqueduct's cost-keeping department.

Throughout the country there are an overwhelming number of illustrations to show that where a municipality undertakes its own public work, the cost and period of construction range from one to one and a half times more than under private contract.

THE CITY DIVIDES THE PROFITS WITH THE WORKMEN

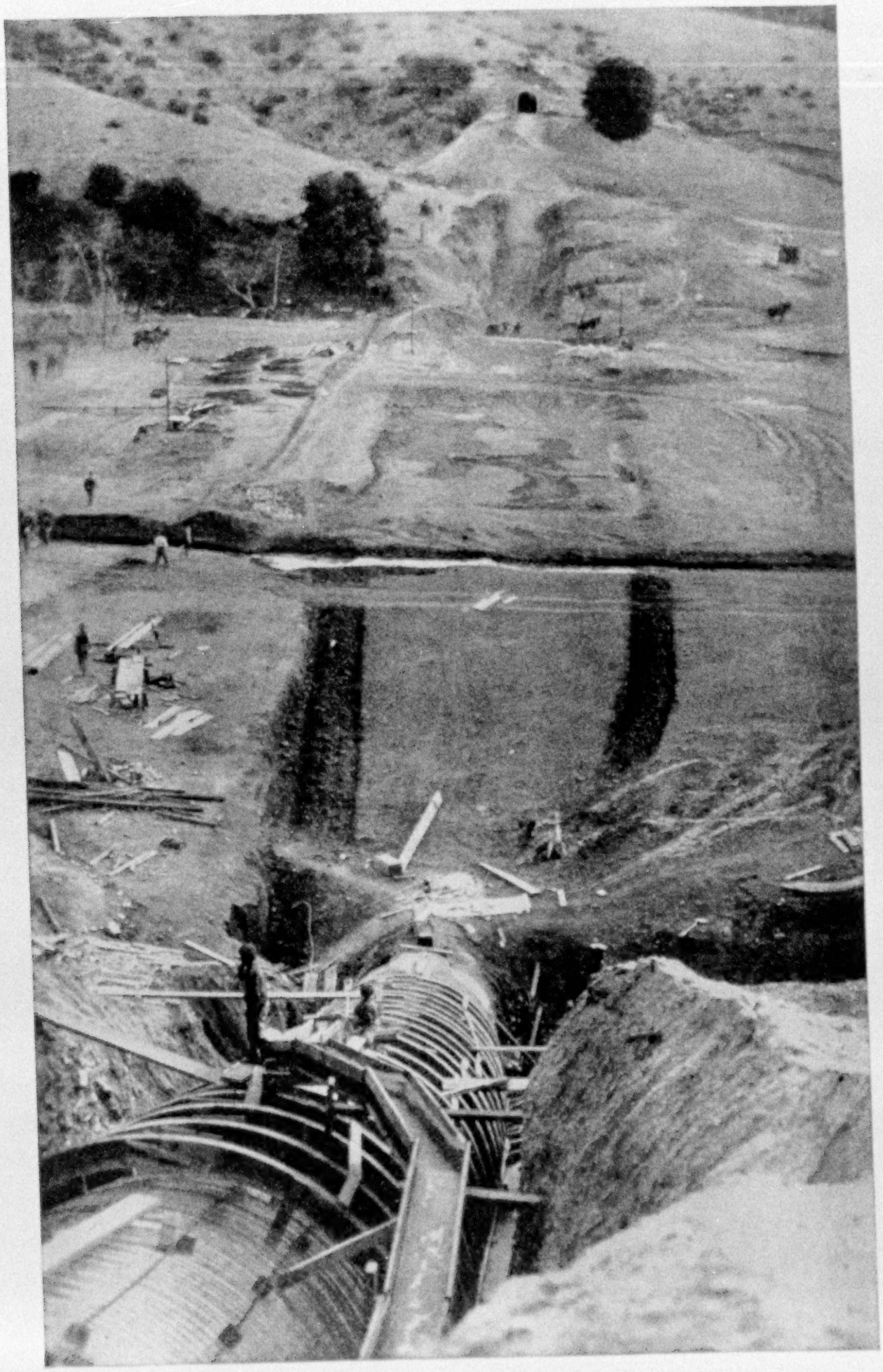
What, then, are the reasons for the unexampled speed and low costs? First, undoubtedly, is the complete preparedness provided before any excavation was attempted. Secondly, the efficiency of the men and the organization of which they are a part. This is a public work without any politics. All employees are American. There is no contract labor employed. There are no men on the pay-rolls who have outlived their usefulness, or have been failures in life and have found a berth because of friendship at the city hall. Youth and virility fill the ranks of the 5,000. Every man in a position above that of day laborer received his certification from the City Civil Service Commission. He holds his place provided he is competent for the duties assigned him and not othewise. He climbs upward and is given preference as he shows himself capable.

Every one works for records. These are published for each 10-day period and sent broadcast by the cost-keeping bureau, and thus the spirit of rivalry is fostered and intensified. When a camp once gains the pennant for good and rapid work it strives with all its might to retain the emblem.

The city further divides with the men the profits which result to the municipality from unusual endeavor on the part of its employees. A careful determination is made of how much tunnel can be bored in a certain character of rock or soil by a crew in 10 days, or the average distance that should be made by a power shovel or a concrete gang in the same interval. Wherever the set distance is exceeded, every 10 days the city pays a bonus to each man for every extra foot accomplished. Under this system the workmen themselves drive out the laggards and the drones. Drones and laggards retard progress and cut down the bonus. That the city's policy is a paying one is shown by the fact that all American records for tunnel boring have been repeatedly broken, as well as those for other forms of excavation and cement working.

The engineers have not participated in the money awards. When the opening of the aqueduct was placed one year ahead of time, an assistant engineer complained to the board: "This is a great thing for the under dog, but where does the engineer come in? His only reward is to work himself out of a job as quickly as possible, while the men under him reap the benefit in increased wages."

"We hadn't thought of that," admitted General Chaffee, who is at the head of the Aqueduct Advisory Board. "We'll look into it." Two weeks later a notice was posted of a substantial increase in



BUILDING AN INVERTED SIPHON ACROSS WHITNEY CANYON TO CARRY THE WATER DOWN ONE SIDE AND UP THE OTHER (SEE PAGE 574)

ANOTHER VIEW OF AN INVERTED SIPHON: IT IS BUILT OF CONCRETE HEAVILY REINFORCED WITH STEEL. (SEE PAGE 576)

UNDERCUTTING FACE OF BANK: THE DREDGE IS DRIVEN BY ELECTRICITY

salaries for assistant engineers and superintendents. A day laborer who has a complaint receives the same courteous treatment and there is the same willingness on the part of the board to investigate.

June 1, 1910, 99.9 miles of aqueduct had been excavated. Of this, 36 miles was tunnel, bored for the most part through solid rock at the average rate of almost two miles per month. Think of it! For the last ten days of May the total distance in tunnel, conduit, and canal excavated was 16,983 feet, or at the rate of very close to *ten miles per month.*

THE SUPPLY AND THE DEMAND

Necessity is a relentless taskmaster, and it was dire need which drove Los Angeles to its conquest of the desert. However, from a commercial viewpoint, the financial returns from this source are small indeed compared with the revenues which must accrue from the sales of water for irrigation and from the disposal of electric energy.

The city paid $2,500,000 in round numbers for its present supply and distribution system. In eight years the actual property value, exclusive of all water rights in the Los Angeles River bottom, has been increased to $6,500,000. All this and much more has been accomplished from the sale of water for domestic use. The city's daily consumption now averages 35,000,000 gallons. With other towns which will draw on the new supply, in 1925 it is estimated 110,000,000 gallons daily will be required for domestic consumption at a rate close to the present one of nine and two-thirds per 1,000 gallons.

The new water supply at its full capacity can deliver 260,000,000 gallons every 24 hours into the San Fernando reservoirs. These, conserving the golden flood during the time of winter rains, when there is least demand, will assure a withdrawal of more than 300,000,000 gallons daily during the five months of the hot, dry summer season. It will thus be seen that much more than half of the aqueduct's capacity can be devoted to irrigation for a very long term of years.

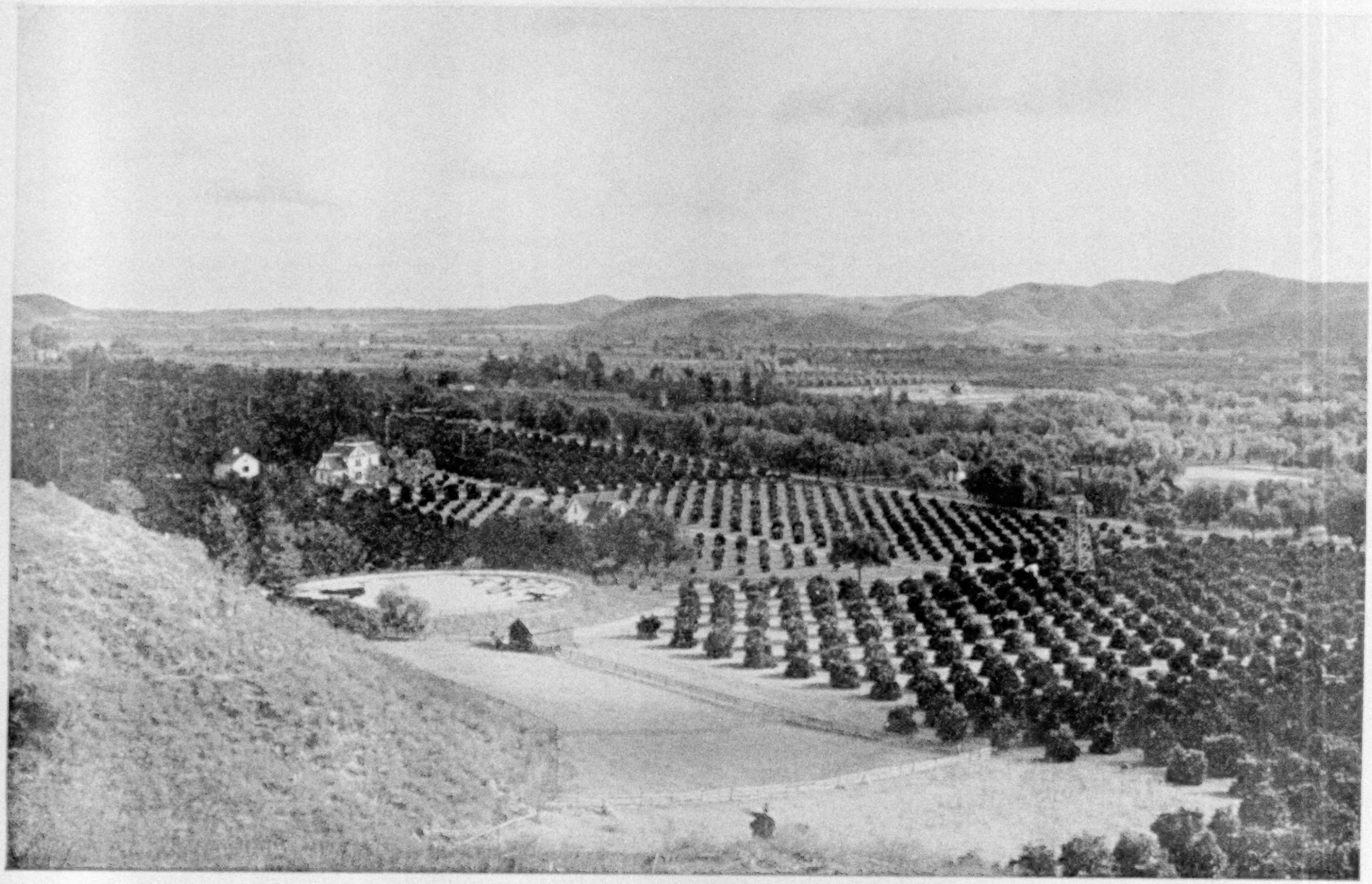
In the San Fernando Valley and spreading out directly beneath the two great reservoirs, government reports show that there are from 60,000 to 75,000 acres of fertile lands which can be made highly productive if water can be brought to them. In the San Gabriel, the Cahuenga, and other valleys, this area is increased to more than 200,000 acres—an area furnishing a market for a larger amount of water than the city will have for sale for irrigation purposes. This several hundred square miles of territory, which for years has been included in a few great ranches, each comprising thousands of acres, is being broken up into small ranches averaging not more than 40 acres, in anticipation of the coming of waters.

These ranches five years ago could have been purchased at from $10 to $40 an acre, which is the average value of lands having no prospect of water. Today they are being sold in the San Fernando Valley at prices ranging from $60 to $200 an acre. Under irrigation and with citrus orchards in bearing, they will command prices ranging from $1,000 to $1,500 an acre, which in the citrus fruit belt is considered an average price.

The increase in the value of these lands has been brought about solely through the city's construction of the aqueduct. As yet Los Angeles has made nothing public concerning any plans it may have for the benefited area to pay a share in the cost of the aqueduct, but undoubtedly some means will be devised by which the territory will pay a just proportion, exclusive of the annual rental which will be charged for the water consumed. The lands, once brought under cultivation, will increase the assessed valuation enormously.

The discussion of electric power possibilities has been left for the last for the reason that it deals with revenues and possibilities of civic greatness which are larger than those of either domestic use or irrigation.

A SCENE IN THE HIGH SIERRA, WHERE THE WATER COMES FROM



A CITRUS ORCHARD IN THE SAN GABRIEL VALLEY, A FEW MILES FROM LOS ANGELES

This photograph was awarded the grand prize in the photographer's contest held by the Chamber of Commerce. Photograph taken January, 1910, by Geo. R. King, Pasadena, Cal.

SPLENDID POSSIBILITIES FOR ELECTRICAL DEVELOPMENT

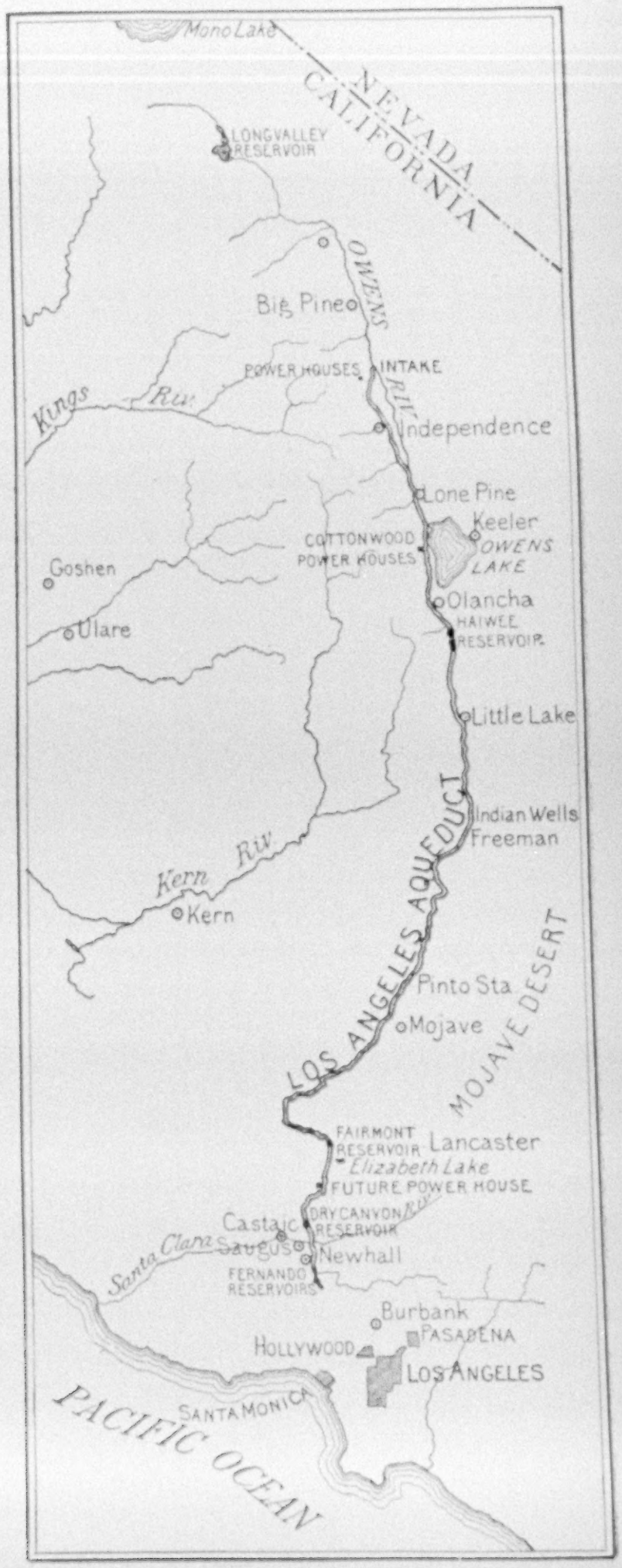
The total output of electric energy, in a report made March 4, 1910, by three of the foremost electrical engineers in the United States, is placed at 120,000 horse-power peak load. Of this amount, 80,000 horse-power can be developed within 50 miles of Los Angeles. April 19, 1910, a bond issue of $3,500,000 was voted by a large majority for the purpose of partially developing this large source of income, estimated at 49,000 horse-power. The hydro-electric plants are to be constructed and ready for operation at the same time that the aqueduct is opened to the flow of the Owens River.

The present consumption of power for all purposes in the entire county of Los Angeles is estimated as not exceeding 80,000 horse-power, of which 55,000 horse-power is consumed within Los Angeles city. It will require a long series of years to find a market for such a large amount of power as the city has at its back, and this is recognized by the development of only a fraction of the possible output just at this time.

Mr E. F. Scattergood, the aqueduct's chief electrical engineer, prepared estimates in 1906 for the development of 37,000 horse-power at a total cost of $4,490,000, the power to be delivered at the city's gates. With the sale of power figured at the low wholesale rate of eight-tenths cents per kilowatt hour, on a 50 per cent load basis, and accounting for all costs of operation, maintenance, interest on bonds, sinking fund, and depreciation of plant, he placed the net annual revenue at $1,406,000.

Mr Mulholland, in a public utterance on this subject, said: "I believe that the people have in the possible power development from the aqueduct an investment which 20 years hence will turn back into the city treasury the entire $24,500,000 provided for the construction of the aqueduct, with interest." His declaration is borne out by the hydraulic and electrical engineers who have been called upon to examine the plans and estimates.

Naturally a part of the surplus power will be taken through the growth of



manufacturing industry in Los Angeles, which has been phenomenal during the past decade. In 1900 the government industrial experts placed the city's manufacturing output at $5,000,000, and in 1905 at $30,000,000. This year Mr C. C. White, of the Census Bureau, in his preliminary investigations, places the total at $75,000,000.

With a cheap and abundant power such as the city will be able to offer, a constantly enlarging market must follow. Two hundred miles south of Los Angeles lies the Imperial Valley. Here for three years experiments in cotton-growing have been carried on. Last year's crop proved the industry a success, with a grade of cotton of a very superior quality. There were 1,000 acres under cultivation then; this spring 30,000 acres were set out to cotton plants. It will be remarkable if this new industry does not bring to Los Angeles likewise a new field for manufacturing. This is only one of the possible means of power disposal at which Los Angeles' commercial bodies are casting longing eyes.

For her own needs and for Pasadena and other cities and towns in the vicinity, electricity will be needed for street lighting, and in the construction of the municipal harbor at San Pedro another field awaits development of the magic juice.

These are lean years for the second metropolis of the Pacific Coast. She is straining every nerve and conserving every energy to meet the demands which her enterprise now makes upon her. With the spirit of the West, she has set out to accomplish, and, with the determination of the West, ultimately she will achieve. But, whatever the outcome and whatever the reward, certainly no municipality has ever waged a battle so remarkable in all its phases as this city by the Western sea.

GUATEMALA, THE COUNTRY OF THE FUTURE

By Edine Frances Tisdel

THE interest of the world is at present centered on the Isthmus of Panama and the wonderful work in progress there, so that in general little attention is paid, except by those commercially interested, to the adjacent group of small independent republics occupying the intervening space from Panama northward to the border of Mexico. They are apt to be thought of as countries continually torn by internal strife, devastated by earthquakes, and ravaged by disease—in fact, a sort of tropical wilderness scarcely worthy of a visit.

Never was there greater mistake. The beauty of the cities, the rapid extension of railroads, the cultivation and enormous proceeds of a wonderfully rich and fertile soil, all convince us of the progress of a people living amidst a wealth of scenic beauty and a perfection of climate rarely equaled.

This is particularly true of Guatemala, the most northern of the group, which, under the long and peaceful administration of President Estrada Cabrera, has been rapidly forging ahead to take its place on an equal footing with other nations of the world.

Three days' delightful sail from New Orleans to Puérto Barrios on one of the fine ships of the United Fruit Company brings us to these sun-kissed shores, where stately palms, stirred by perfume-laden breezes, wave in greeting.

The steady increase of American and German interests here is fast opening for our benefit one of the loveliest countries in the world, and the building of railroads is placing within easy reach the enjoyment of its natural beauties.

THE SUCCESS OF AMERICAN INDUSTRIES

All of the railroads are owned by an American syndicate and are absolutely under American control. From Puérto Barrios, on the Caribbean, the Northern road runs a distance of 224 miles up to the city of Guatemala, the capital. From here starts the Guatemala Central road, extending a distance of 74 miles to the port of San José, on the Pacific. The Guatemala Central Railroad has in all 216 miles of road throughout the country, and now in course of construction is a branch line 38 miles in length, to run from the city of Rétalhuleu to Ayutla, on the border of Mexico, to connect directly with the Pan-American road there. In a few months it will be possible to travel by railway from New York city to the capital of Guatemala.

This country was for centuries the home of the Maya-Quiché Indians, whose history reads like a romance. Cortez, however, after the conquest of Mexico, desiring to extend his power over the country farther south, in 1522 sent an invading army under the command of Pédro de Alvarado to subjugate this powerful race.

Leaving Mexico with some 300 Spaniards and a great number of Mexican Indians, Alvarado fought his way into Guatemala, overcoming all who opposed him, and finally, on July 25, 1524, founded the first Spanish capital under the name of Santiago de los Caballeros (Saint James of the Cavaliers). And so it happened that, in a beautiful valley at the foot of two great volcanoes, "Agua" and "Fuego" (meaning water and fire), was firmly established the Spanish rule which was to last for nearly three centuries—that is, until September 15, 1821, when Guatemala became an independent republic.

This first Spanish city was, however, 20 years later, almost completely wiped out of existence by a great flood of water which poured down upon it from Agua. There has been much controversy among scientists as to the origin of this flood. Some claim it to have been the result of a cloudburst, others that it came from the crater of the supposedly extinct volcano. The former supposition seems to be the most plausible, as research has so far failed to discover traces of a considerable body of water ever having existed in the crater.

The few survivors fled down the valley and at a distance of three miles chose the site of a new city, and, in 1542, courageously founded a second capital, now known as Antigua. In time it grew to have a population of 100,000 inhabitants, and became a great center of learning, with many universities, monasteries, and over a hundred churches rich in works of art. Although many times threatened by earthquake shocks more or less severe, it flourished until July 29, 1773, when, without warning, in one minute the proud city was leveled to the ground.

THE RELOCATION OF GUATEMALA'S CAPITAL

Again the survivors of this second calamity sought refuge farther away from the threatening volcano, and, at a distance of 35 miles, finally settled in the beautiful valley of Las Vacas. Here, at an altitude of 5,000 feet above the sea, surrounded on all sides by soft green hills, behind which loom the imposing heads of three volcanoes, lies the city of Guatemala, the present capital, founded by the courageous survivors of one of the greatest calamities in the history of any land.

This typical city of Spanish America is a most interesting and charming place to visit. Coming directly from the land of sky-scrapers, the first impression of it, with its low white buildings, is particularly attractive. Here and there is a house tinted a bright pink or a vivid blue, thus varying the monotony of the dazzling white and lending a sort of holiday look, as though the houses had put on their best gown to welcome the stranger.

The climate is one of perpetual spring, the average temperature being about 70 degrees. The summer months bring the heavy rains.

Although in a land of earthquakes,

XUM

BELLS TAKEN FROM CRUMBLING TOWERS OF CHURCHES DESTROYED BY EARTHQUAKE

this city has suffered little from them, only experiencing slight shocks from time to time. During my entire six months' stay in this country I did not feel even a tremor, and I really think that my friends were rather disappointed when I returned and was unable to give thrilling accounts of one of nature's upheavals.

With a population of 100,000 inhabitants, the city is laid out on a splendid scale, with broad avenues, fine parks, and handsome buildings. It is one of the best-lighted cities in the world. Street cars, little mule cars, run from one end to the other, and already a concession has been granted to an American syndicate for the construction of an electric line.

In the center of the city is the Plaza de Armas, with its pretty park, where stands the handsome statue of Columbus. This plaza becomes the rendezvous of fashion three or four evenings of the week, when an exceptionally fine band plays. Here also each morning at 10 o'clock a company of the President's Guard of Honor parades. Most interesting scenes are also witnessed on the nights of any national holiday or church festival.

The Indians come in from the surrounding country early in the day and install themselves in picturesque groups, selling native sweets, cocoanut water, and beautiful fruits. As night comes on they build fires which illumine their dark faces and brilliant costumes. The trees are hung with gay lanterns and at one side is stretched a great canvas upon which a free moving-picture show is in progress.

The band plays, and between times is heard the rather weird music of the marimba. This native instrument has a peculiar charm and, in spite of a certain metallic sound, not unlike a xenophone, when played in the open air has very beautiful tones. Often in the dead of night one is awakened by the plaintive tones of one of these instruments as some dark-eyed senorita is being serenaded.

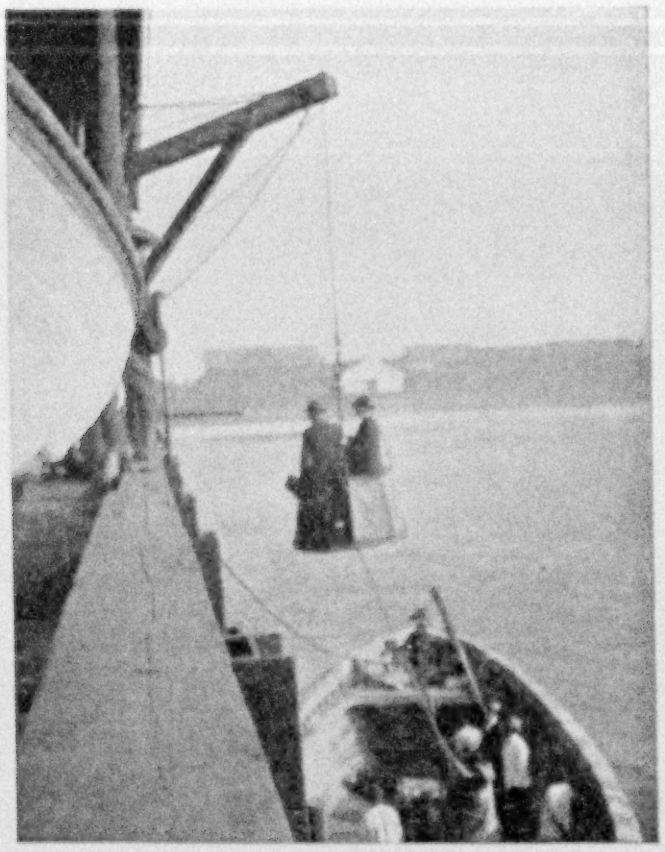
The Cathedral, which stands facing the plaza, with its two square towers, is a fine example of the churches of Spanish America. A curious but not unpleasing effect is obtained in the interior by the blue-and-white ceiling. All the churches of the city are rich in wood carvings, paintings, and antique altar silver saved from the ruins of Antigua.

Throughout the country wherever the churches have suffered from earthquakes and the crumbling towers are no longer strong enough to bear the weight of the heavy bells, these are hung out of doors under a pointed thatched roof held by bamboo poles, which adds greatly to the picturesqueness of the landscape.

The Téatro Colon, the national theater, is a building of which any city would be proud. It is copied from the Church of the Madeleine in Paris. It is generously subsidized by the government, and good operatic and dramatic companies come from Italy, Spain, and Mexico. Bull-fighting is, of course, the favorite amusement, and there is a good bull-ring.

To the west of the city stretches the broad avenue of La Réforma, a beautiful drive several miles in length, shaded by great trees and containing some fine statues, the two most important being those of Gen. Rufino Barrios and Gen. Garcia Granados. At the beginning of the driveway stands the artillery barracks, a rather imposing building, and at the opposite end is the National Museum.

At the other end of the city is the wide boulevard leading to the hippodrome or race-course. Here we come upon the beautiful Temple of Minerva. President Cabrera believes in education, and under his enthusiastic directions there is no little town but has its public school. To commemorate the education of the youth of the country, he has set aside one day each year—the last Sunday in October—as a popular festival, and all scholars and teachers take part in the celebration, which is known as the Feast of Minerva. In each town of any importance is now to be found one of these temples.



LANDING PASSENGERS AT THE PORT OF SAN JOSÉ, ON THE PACIFIC

HOW GUATEMALA IS GOVERNED

The government of Guatemala is republican, the president's term of office being for six years. The legislative power is vested in a national assembly, which consists of one house composed of a deputy for each 20,000 inhabitants. Beginning the first of March, the annual sessions are held, lasting two months.

I well remember on the day of the convening of Congress that I expressed a desire of attending, as in other countries, one of the sessions. Had I dropped a bomb in the midst of the group who overheard the remark I could scarcely have caused greater excitement. "Impossible! Unheard of! Women did not go to Congress," etc.

The rumor spread, however, that the American girl wished to go, and a few days later my father received a gracious note from Señor Ubico, President of the Senate, inviting us to be present on a certain evening, for the meetings are held at night. Nearly a hundred members were present and several important bills were passed, among them one granting the concession for the building of the international bridge over the Suchiate River on the border of Mexico. It was most interesting and I had the honor of being the first, and, as far as I know, as yet, the only woman who has ever been admitted within the Congress Hall of Guatemala.

I was fortunate enough, also, through the courtesy of President Cabrera, to be shown the Palace, another place a woman has never been admitted to. Soldiers were drawn up and presented arms as we entered the large court, and we were met by one of the generals, resplendent in gold lace, whom the President had detailed to escort us. The wide white marble stairway, the reception rooms, and banqueting hall would bear comparison with many in the royal homes of Europe.

It was here that, on March 11, 1909, President Cabrera entertained Rear Admiral Swinburn, then in command of the American Pacific squadron, and some 30 of his officers. Never have I seen such

Indian Servants in Native Costume. Domestics receive $3 per month in Guatemala City

Indian Woman at Work in the Cotton Factory of Cantel

Indian of San Lucas. Costume of red and white stripes, the people resembling animated sticks of peppermint candy.

Little Indian Girl whose Name was Elvira Apolonia, known as "Apollinaris"

lavish expenditure as during the four days when our officers were this nation's guests. The city was gay with flags, flowers, and illuminations. The ball given by the city, and at which 800 guests sat down to supper in the beautiful "patio" of the Municipal Palace, was the most gorgeous affair of its kind I have attended.

These patios, or courts, are characteristic of the buildings, public or private, throughout the country. Here indeed a man's house is his castle.

The windows looking onto the streets are rarely opened, and for good reason. What in our country are known as sneak thieves here have an original way of obtaining their spoils. A long string with a fish-hook at the end is the instrument employed, and this, thrown in between the bars with a dexterity equal to the lasso-throwing of the cowboy, falls unerringly upon the chosen object, which in a twinkling is whisked away. Woe to the person who, leaving his things scattered around, goes out of the room without closing the window.

THE SELF-APPOINTED REGULATORS OF THE PUBLIC HEALTH

"The National Health Department," as it is amusingly nicknamed, is also most original. Sopolotes, or buzzards, are the scavengers of the land, keeping country and city scrupulously clean. One soon becomes accustomed to the long rows of these solemn but ungainly birds patiently waiting to pounce upon any morsel thrown out. Soap is their favorite dainty, and, as they are great thieves, it is impossible to keep a piece of this particular article unless well hidden.

Living is cheap here and housekeeping not difficult, particularly if one knows a little Spanish. The markets, besides being attractive and picturesque, are excellent. There is no fixed price for anything, and one soon learns to offer just half of what is asked. Then naturally follows more bargaining, and one finally gets the goods for at least two-thirds less than the original price. The servants are mostly Indians and are exceptionally

MOVING PICTURE POSTER ADVERTISEMENT SEEN IN CARIB VILLAGE

good. They learn quickly, and with a little patience can soon be converted into model domestics. Their wages are about 50 pésos, or some $3 gold, a month.

The signs over the shops are sometimes puzzling and often amusing. I remember one in particular, which translated reads, "Milk from the cow's foot." It meant that the cow would be brought to the door and milked before one's eyes. Whether this improved the quality of the milk I was never able to determine.

The most original sign seen in Guatemala was a poster advertisement of a moving-picture show. This was on the wall of a native school-house in the Carib village at Livingston. It read:

> "Tonight, in the Practical School, the Life and Passion of Christ and *other comic* moving pictures."

THE ANCIENT CAPITAL OF ANTIGUA

In strange contrast to the modern city of Guatemala is the old ruined one of

TYPICAL STREET SCENE IN THE CARIB VILLAGE AT LIVINGSTON

In which the poster shown in the preceding picture was seen

Antigua, which I have mentioned, and which to those remaining only a short time in the country is the most important place to visit. It is preferable to ride, although one can drive in old-fashioned canvas-covered diligences. The earlier the start after sunrise the better, for the road as far as the Indian town of Mixco presents a most attractive scene, as hundreds of Indians are jogging into the city heavily laden with great loads of earthen pottery, fresh fruits, and vegetables for the market. Mixco is picturesquely situated, nestling at the foot of the mountains and commanding an extended view of the great Guatemala Valley, with the city almost at one's feet, and in the distance the sparkling blue waters of lovely Lake Amatitlan.

Leaving the highroad one turns into a narrow defile, and up and down hill follows an old Indian trail, sometimes completely shut in, again widening with glimpses of the mountains as range after range rises to the imposing heads of three great volcanoes—Agua, Fuego, and Acatenango.

I do not know of any place I have visited, not even Pompeii, which made such a deep impression upon me as this city of the past.

Nestled in a broad, fertile valley, the climate of which is unsurpassed, nothing can exceed it in solemn grandeur. Watched over by the giant Agua, which rises in one magnificent unbroken sweep to a height of over 13,000 feet, street after street stretches dazzlingly white in the brilliant sunshine. Not a sound breaks the silence which hangs like a pall over the place, and even the modern town of some 30,000 inhabitants seems dead, and a strange hush lies over all.

The quaint little pink hotel, with its flower-filled patio, the air heavy with the scent of roses, orange blossoms, and starry-eyed jasmine, is in keeping with the atmosphere of romance which pervades the place.

Of half a hundred churches still standing, those of the Cathedral, San Francisco, and Récollecion are the most imposing. Of the first-named enormous edifice, 300 feet in length, only the outer walls, pierced by 50 windows, and a few graceful arches remain of what must have been a wonderfully beautiful building. The bright blue sky looks down on a tangled mass of trees and flowers, and here in the midst of this sad reminder of past grandeur lives an Indian family, the roof of their outdoor kitchen supported by wonderfully carved pillars of wood.

A woman was kneeling in front of a large stone slab upon which she was pounding wet corn preparatory to making "tortillas," the flat corn cakes which, with black beans, is the staple food of the country. We were invited to stop and watch the process, and boxes and a dilapidated chair or two were brought forth from some mysterious recess for our comfort.

HAPPY CHILDREN OF GUATEMALA

GUATEMALAN GIRLS DRESSED FOR FIESTA

The picturesque corner, with the Indian woman in her native costume kneeling in the light of a flickering wood fire; round-eyed, staring children of all ages; dogs, chickens, and pigs innumerable; the exquisitely carved pillars etched against the gray background of ruined walls, and the delicate branches of a cherry tree in full bloom, giving the harmonious touch of color—all combined to make a picture never to be forgotten. As the twilight fell dark figures glided silently by, balancing on their heads large flat baskets of fruits for the morrow's market, and seeking a resting-place beneath the dim arches, where here and there heaps of corn husks showed that at night this grim pile was not untenanted.

The ruins of San Francisco are also most impressive, and from the crumbling belfry is obtained a magnificent view of city and surrounding country.

The beautiful ruins of Récollecion are the property of a German-American priest, who reaps great benefit from his gardens and coffee plantation, which he cultivates during his leisure hours. It seemed rather incongruous to see fat black hogs contentedly rooting under the shadow of these historical walls, but this "padre" is nothing if not practical.

Not far from here is the estate of "Pastorès," where there is a large flour-mill, the only one of its kind in this part of the country.

Three miles from the city are the beautiful warm sulphur baths of Médina and Cubo, to reach which one passes through great sugar plantations on roads in perfect condition, shaded by trees which, meeting overhead, form a cool green archway as far as the eye can see. Further on is Cuidad Viéja, the site of the first capital. All that remains of historical interest are the two crumbling walls of what was at one time the palace of the conqueror.

MISCO INDIAN ON ROAD FROM GUATEMALA CITY TO ANTIGUA

SCENE IN THE "VIRGINIA" BANANA PLANTATION OF THE UNITED FRUIT COMPANY: GUATEMALA

The plantation covers 5,000 acres and ships 300,000 bunches of bananas each year (see page 609)

CARIB WOMEN OF LAKE ATITLAN

INDIAN BOYS IN SCHOOL, ON LAKE ATITLAN

There is a school-house in every village. The government is doing its best to give the Indians some education, but the indifference of the parents and the difficulty of finding competent teachers handicap the work exceedingly.

INDIANS AT LAKE ATITLAN (SEE PAGE 621)

All the garments worn by these Indians are of native manufacture. The looms on which the handkerchiefs and shawls are woven are just the same as those pictured in the aboriginal Mexican manuscripts

XUM

DEVELOPMENT OF THE EXPORT TRADE

There is a fascination about this valley impossible to describe, and a spell seems to be cast over all who come here. It is difficult to tear one's self away and return to the busy life of the outer world, which in this country, however, can be seen to the best advantage on the great banana, coffee, and sugar estates, or "fincas," as they are called.

Bananas are grown almost exclusively on the Atlantic side. The largest banana plantation of the country is that of "Virginia," owned by the United Fruit Company of Boston. It covers 5,000 acres of land and exports annually 300,000 bunches of bananas, the total export from all sections of Guatemala being 1,500,000 bunches. The output of the United Fruit Company's Guatemala, Panama, Colombia, Costa Rican, and Jamaica plantations exceeds 22,000,000 bunches of bananas a year. The company has some 70 ships of from 3,000 to 6,000 tons running to the United States and Europe.

Almost the entire Pacific slope is given over to the cultivation of sugar-cane and the raising of cattle.

The best coffee is grown in the highlands at an altitude of from 1,500 to 5,000 feet.

THE COUNTRY'S PRODUCTION OF SUGAR

From the city to the port of San José, on the Pacific, the Guatemala Central Railroad passes the largest of the sugar estates. San José is the seaside resort of the country during the months corresponding to our winter, and here one finds a good hotel, fine bathing (although the undercurrent is to be feared), and a splendid iron pier some thousand feet long. The landing of passengers here is amusing to the onlooker, but far from reassuring for the ones concerned, who dangle helplessly in midair in a sort of iron cage, as steamers cannot come up alongside of the pier, and a small boat has to be the means of transfer.

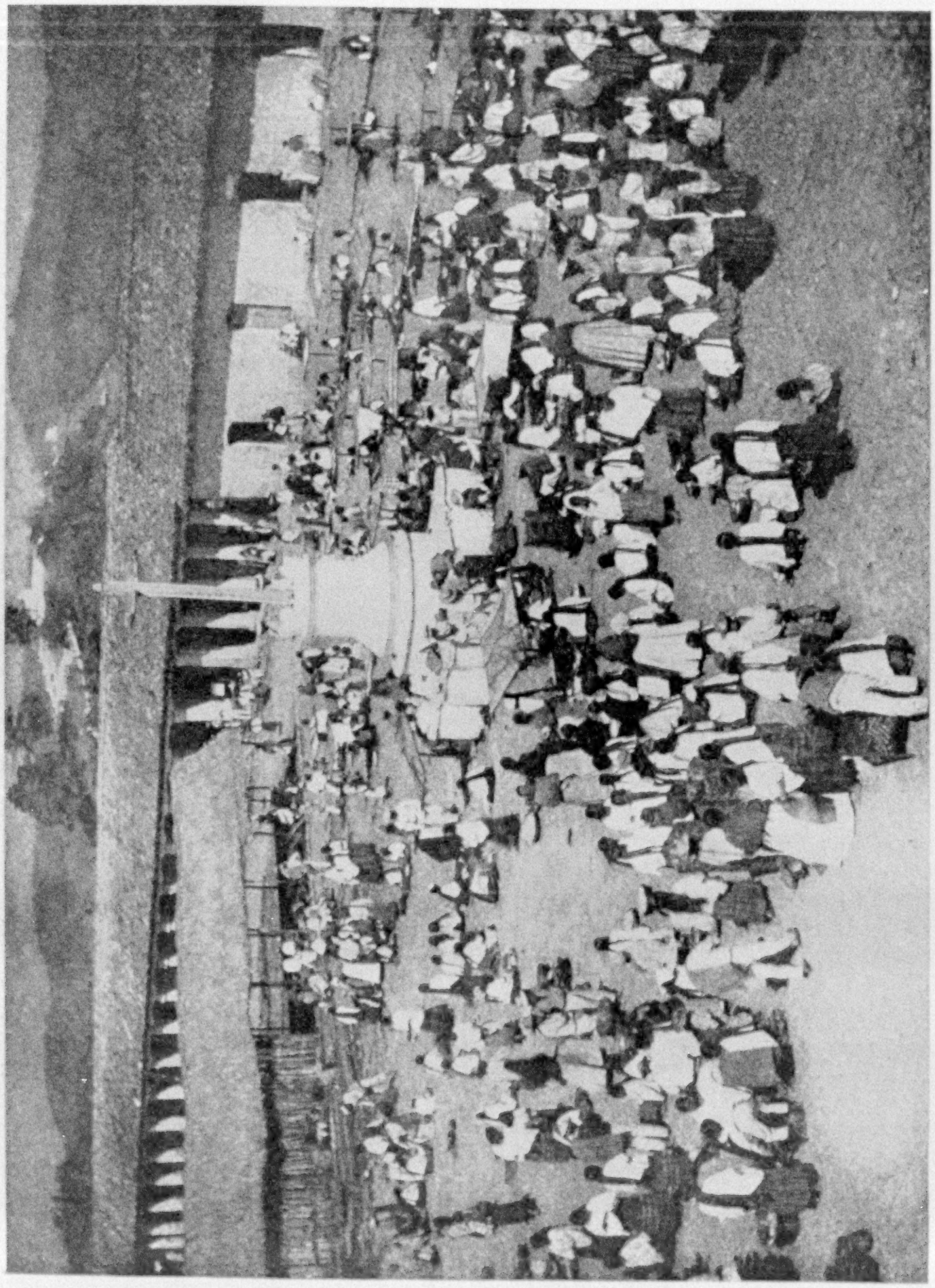
But to return to the sugar. Shortly after leaving Guatemala City, the road follows for 15 miles the borders of Lake Amatitlan, where the Indian women of the city take advantage of the boiling springs which abound all along this body of water for their laundry work. At the town of Palin one is greeted by an extremely picturesque scene, for the train is besieged by Indians in gay costumes balancing on their heads large flat baskets of gorgeous tropical fruits—"forbidden fruit," indeed, to the traveler until thoroughly acclimated. I have never eaten such luscious pineapples as are grown here, besides many wonderful and delicious tropical fruits of which we of the North know nothing.

Here we are directly on the opposite side of Agua from Antigua and a magnificent panorama lies before us—on the right the fertile slopes of the great volcano, and before us the smiling, sunlit plain stretching away 40 miles to the blue waters of the Pacific.

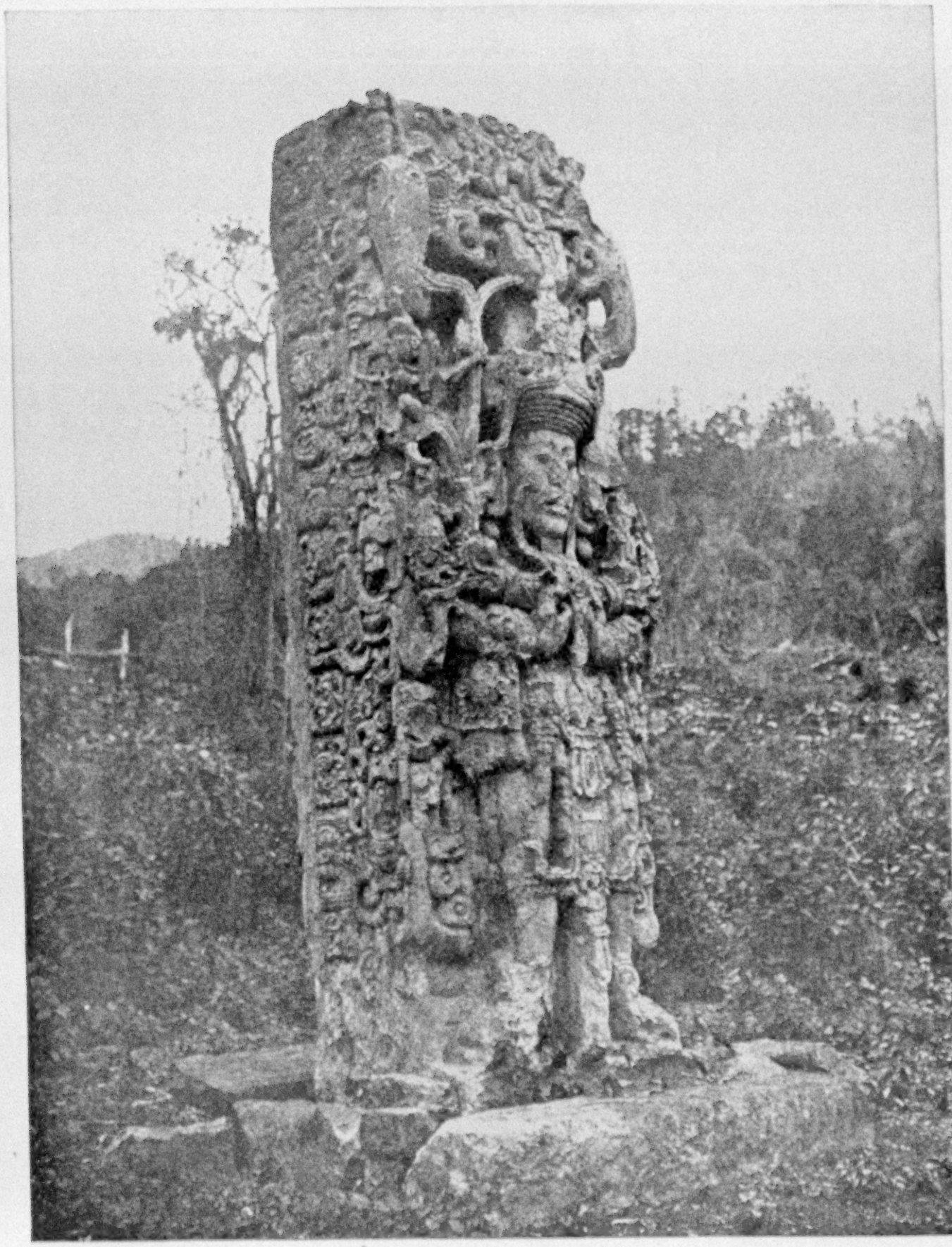
Concépcion is perhaps one of the most interesting of the many large plantations. It covers 155,000 acres and produces each year 10,000 tons of sugar, 20,000 bags of coffee, besides many hundred head of cattle and thousands of bushels of corn. It belongs to a German syndicate and is valued at 1,000,000 marks ($250,000), on which it pays 15 per cent.

All of these estates have miles of private railroad, and a continual stream of little cars piled high with sugar-cane run from the distant fields to the factory. The process of sugar-making is interesting to watch from the very beginning, when the juice is crushed out of the cane by giant machinery. The dry fiber is then used to stock the enormous furnaces over which seethe and bubble huge caldrons of syrup. Boiled down to a soft mass like caramel, it is poured into shallow vats to cool. The unrefined sugar, of a dark-brown color, is commonly used throughout the country. It is called "panela," and is molded into half-round cakes, of which two together make a ball, and is then curiously wrapped in corn husks.

The dwelling-houses on all the estates are invariably comfortable, with wide, shady porches and every modern improvement and convenience, at night being lighted by electricity.



THE PLAZA AT COBAN, GUATEMALA



ONE OF THE MONOLITHS AT COBAN

Old Palace of the Viceroys: Antigua

Street Scene in Antigua: Arch of Santa Catarina

Street Scene in Antigua, with view of the volcano "Aqua"

Ruined Church of La Mercedes: Antigua

XUM

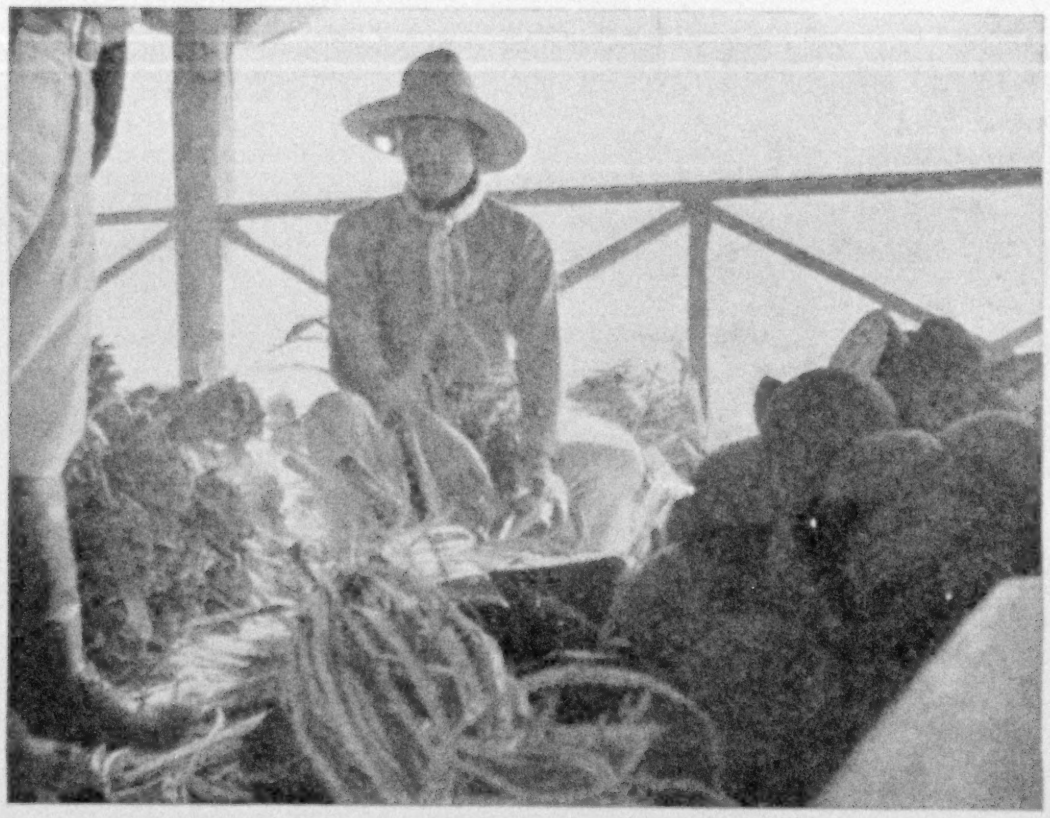
SKETCH MAP OF GUATEMALA

It was my good fortune to stay at several of these *fincas*, and none more lovely than Pacayal, a coffee plantation way up in the mountains at an altitude of 5,000 feet. It is a 30-mile horseback ride after leaving the railroad at the station of Cocales. We stopped over night at the Indian town of Patalul, where there is a new hotel, primitive but clean. We rode into this town at sunset to find ourselves in the midst of a real country fair.

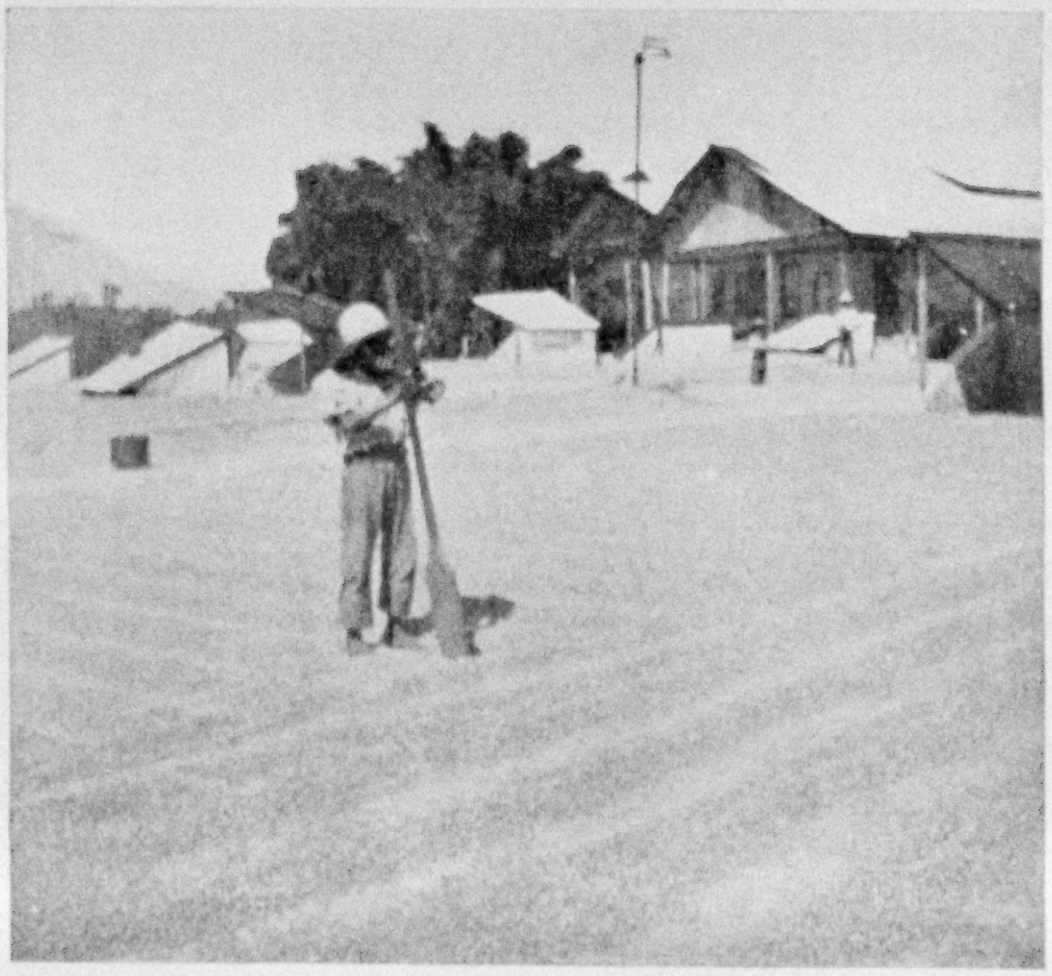
It was an odd scene, the booths of bamboo and groups of dark-faced Indians squatting around camp-fires. The sound of bells and discordant music reached us, and as we came in front of the church a procession was just coming out, headed by a life-size figure of the Virgin, borne on the shoulders of women. It was the finishing touch to an already unusual scene, as it wended its way down the crooked streets between the fires, the twinkling lights of many waxen tapers and the crimson glow of the sunset heightening the already brilliant coloring of the native costumes.

THE CULTIVATION OF COFFEE AND THE INDIAN LABOR

Pacayal, an estate of some 8,000 acres, boasts some of the finest coffee in Guatemala. Coffee is not a natural product



INDIAN WRAPPING SUGAR BALLS ("PANELA") IN CORN HUSKS (SEE PAGE 609)
The half-rounded cakes on the right are unrefined sugar



ONE OF THE LITTLE INDIAN BOYS ENGAGED IN PUSHING THE LONG ROWS OF COFFEE BEANS BACK AND FORTH IN THE SUN: PACAYAL (SEE PAGE 615)

of this soil, having been introduced into the new world by a Spanish priest in Guatemala, who obtained the seed from Arabia. The trees are first raised in nurseries, and when a few months old are transplanted. A coffee field in full bloom, with its wealth of fragrant white blossoms, is indeed a beautiful sight. When ready for picking the bright red berries greatly resemble cherries.

When we arrived at Pacayal the Indians were still harvesting, the result of a good day's work being about three bushels of berries apiece. Each day these are weighed, the pickers receiving a check and being paid off in full every Saturday. They earn about seven or eight cents a day for twelve hours' work, besides a home, which consists of a bamboo hut. There is little discontent among these children of the open air, except when occasionally a bottle of "guaro," the cheap alcoholic drink of the country, is smuggled onto the estate. This is generally accomplished by some loving spouse, who travels under cover of the night and by stealth to the nearest village to obtain the coveted beverage for her liege lord.

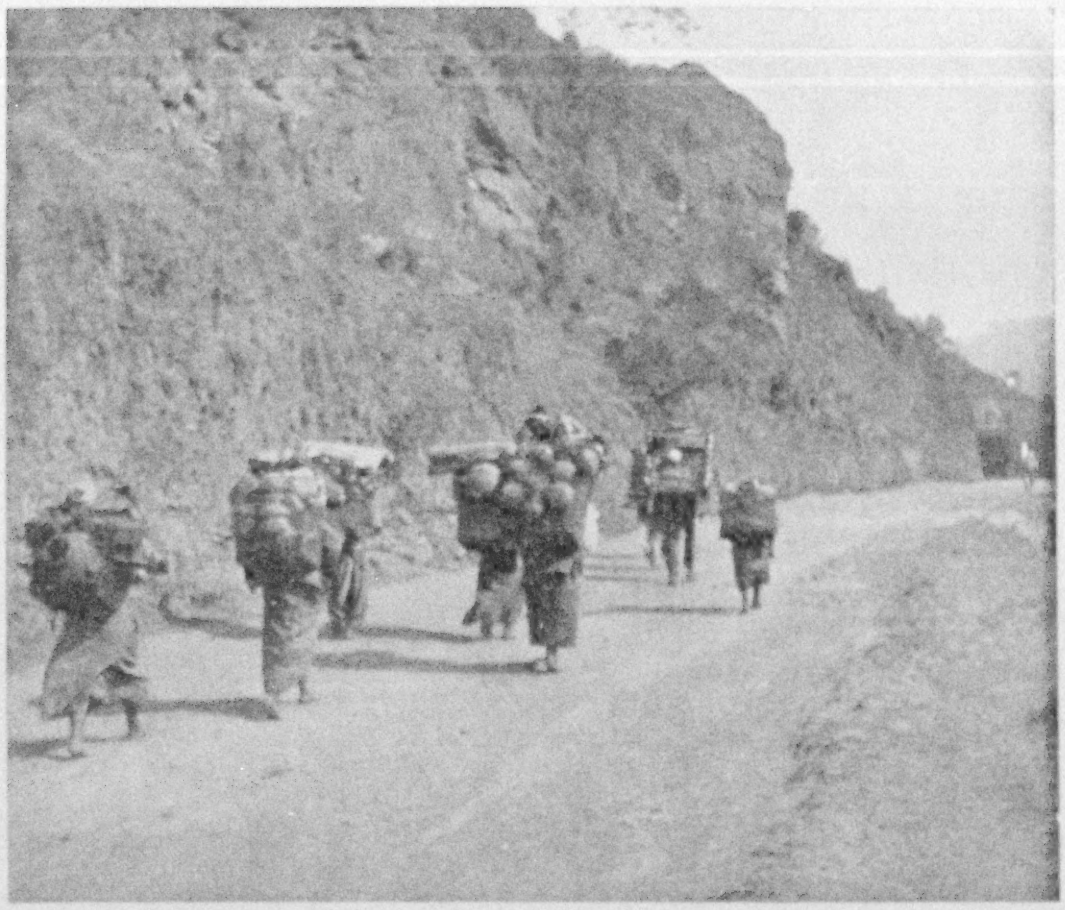
As soon as picked the coffee is pulped to prevent fermentation in the pulp, which would stain the bean. From the pulper it goes into great fermenting tanks, where it remains from 24 to 48 hours, in order to take off the sweet, gummy substance which is on the hull. It is then washed and spread to dry in the sun on large asphalt terraces called "patios." When thoroughly dry it is put through a huller to take off the fine silvery skin, and is finally ready for the market. One bushel of berries gives ten pounds of cleaned coffee. The crop of Pacayal last year was 20,000 bags. Each bag is of 130 pounds.

We had many a delightful dance in the moonlight on these slippery patios, which at night make ideal ball-rooms.

Many children are employed all day in ceaselessly pushing back and forth the long rows of coffee beans, and at night brushing them under cover as protection from the dew. It was amusing to watch them, and we became much interested in one boy in particular as an example of what teaching and the influence of civilization can do. He had been brought to the *finca* a few years before from the mountains, where his parents were wild people, living upon raw things and knowing nothing of the uses of water except as a beverage. He had learned quickly, and during our visit was promoted to the dining-room as "assistant butler." Disliking the length of his hair, however, we attempted to cut it; but, as we only had finger-nail scissors, the result was somewhat startling. It gave his head a Marcel-wave-like effect unusual even among Indians, and from that time on he would have nothing more to do with us. His name was "Saie."

An early morning ride to the adjoining sugar *finca* of Saint Emilia was the most beautiful I have taken. Single file we picked our way through the dense tropical forest. A wilderness of giant trees linked together by trailing vines; a profusion of vari-colored orchids; a soft pink carpet of waxen begonia; great splashes of scarlet made by the peculiar blossom of the plantain, and here and there an enormous poinsettia bloom. Over all a tangled mass of blue-and-white morning-glories heavy with sparkling dew. Coming out suddenly upon the brow of a hill, we saw the white houses of Saint Emilia lying 1,500 feet below, like jewels in a green velvet case. Behind towered the mountains and in the distance sparkled the blue waters of the Pacific.

In this same part of the country, tucked still further away in the mountains, at an altitude of 8,000 feet and 40 miles from the railroad, lies the interesting city of Quézaltenango. In April, 1902, it was almost totally destroyed by an earthquake, which occurred at the same time as the wholly unexpected eruption of the volcano Santa Maria. Like the Italians who time after time fly in terror from the shadow of the dread Vesuvius and invariably return, so the people of this country only momentarily abandon their homes. In this city of



INDIANS ON THE ROAD TO QUEZALTENANGO AND CANTEL, CARRYING GREAT LOADS OF POTTERY AND FRESH FRUITS TO MARKET

INDIAN WOMEN OF CANTEL COMING FROM THE FOUNTAIN
These women make excellent workers in the cotton factory

some 23,000 inhabitants we find the unique sight of stately new buildings side by side with crumbling ruins. A partially successful attempt has been made to rebuild this once beautiful city.

The theater is, if anything, finer than the one in Guatemala City, but unfortunately stands dark and silent most of the time, as few companies venture so far from the beaten track.

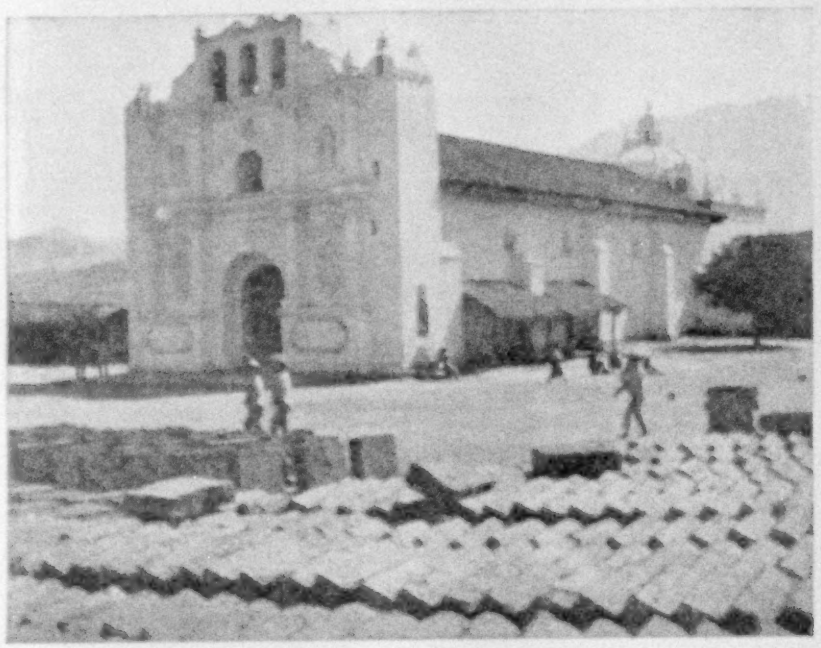
The market here is unusually interesting, being the center of trade for this section of the country. In none other did I see such brilliant coloring as shown here by the costumes of the different tribes of Indians.

It was not far from here that I visited, at a place called Cantel, to my mind one of the greatest tributes to American energy and enterprise in the country. Nestled in a fertile valley is a large cotton factory, the only one of its kind in the republic. Think of a model factory, employing some 400 or 500 hands, where every bit of machinery used has been brought on the backs of Indians or mules. The factory hands are all Indians, mostly women and children, the dexterity of the latter being fairly astonishing.

SCENES IN THE MARKET: QUEZALTENANGO

To reach Cantel one must leave the railroad at the Indian town of San Félipe and ride 40 miles up into the mountains. We follow for several miles a level road bordered by lovely coffee *fincas*, the mountains looming ahead dark and forbidding but gradually softened by the light of coming day to a velvety, misty blue against the pale pink of the sky. The road winds almost completely around Santa Maria, which rises to the towering height of 11,000 feet.

As we drew nearer, what at first seemed to be soft, fleecy clouds proved to be clouds indeed, but of steam issuing from the great jagged crater in her side. From here the road begins to ascend, winding up, up, seemingly interminable, like a great white snake crawling into the very heart of the mountains. I was quite unprepared for the grandeur of the scenery, which surpassed anything I had yet beheld. Soft green valleys a thousand or two feet below; range after range of mountains rising on either side and looming in front like an impenetrable barrier; rushing, tumbling mountain torrents, falling hundreds of feet in



View of the Cotton Factory of Cantel, built by enterprising Americans 40 miles from the railway (see p. 617)
Church in the Village of Cantel. Adobe bricks spread in the sun to dry

Looms in the Cotton Factory of Cantel

Street Scene in the Village of Cantel

beautiful cascades; above all, the majestic head of Santa Maria lazily puffing out soft clouds of steam.

WHERE NATURE PROVIDES STEAM HEAT

Still further on the road for miles skirts the edge of a deep ravine, and, looking down hundreds of feet, one sees great columns of steam, rising geyser-like, at regular intervals. Along the way from every little crack and crevice in the rocks small puffs of steam also issue, and we suddenly shiver as the realization is borne in upon us that the path we so gayly pursue lies over the heart of a live volcano, which at any moment may again bring devastation and death to this lovely land.

Here and there were groups of sleeping Indians, huddled together wherever steam was coming from the ground. If one must sleep under the stars on frosty nights, it is surely convenient to find already prepared a system of steam heating quite equal, to all intents and purposes, to that which in modern homes is the cause of so much trouble and expense.

This is the great highway from the interior to the coast, and a never-ending stream of traffic moves constantly up and down, presenting a most interesting scene; chiefly Indians, heavily laden with every conceivable article: great loads of curious water-jars, earthen pottery, coffee, sugar, fruit, and vegetables. Then large droves of hogs and fifty or a hundred mules. Most interesting of all to me were the innumerable teams of oxen, patiently drawing great creaking loads of raw cotton destined for the far-away factory.

The lakes of Guatemala are not numerous, but are very beautiful. We have already glimpsed at Amatitlan, and, still further off, again up into the mountains, lies the crater lake of Atitlan, incomparable for beauty and magnificence of scenery.

To avoid the heat of the day—for the season was already advanced—we arranged to journey thither by night. The proceeding was a little unconventional and rather a shock to our native friends; but, then, anything was to be expected of "gringos," or foreigners. So just at sunset we mounted our mules at the station of Cocales and started gayly off on our 30-mile ride. Up and down hill, through the beautiful country bathed in moonlight; fording numerous mountain streams looking like cascades of silver; through silent Indian villages, where the inhabitants were all sleeping in the open air in front of their queer little bamboo huts. The only sound to break the silence which brooded over the land was the plaintive call of the whippoorwill and the occasional song of the nightingale.

ATITLAN, THE CRATER LAKE

At midnight we reached the borders of the lake, and at the village of San Lucas took a little steamboat that was in waiting to carry us across to the hotel on the opposite shore. The great expanse of water lay like molten silver in the moonlight, the mountains standing in serried ranks like giant sentinels to guard this treasure. A soft white haze hung over all, but not too heavy to hide the perfect outline of the two gigantic volcanoes, Atitlan and San Pédro, rising from the water's edge in one magnificent sweep to the height of 12,000 feet.

As we approached the shore a picturesque scene was revealed. The little hotel stood out white and clear against the dark background of the hill, and below, at the landing place, a group of Indians awaited our arrival, the red glare from many torches casting a lurid glow over the picture.

Owned by a German, whose business and pleasure it is to raise countless canaries, this little inn is one of the best in Guatemala. The office presents a unique appearance. From every corner comes the twittering of the tiny feathered inhabitants of many cages, and the walls are curiously papered from floor to ceiling with $50,000 worth of shares of a steamboat company, whose boats were to have plied the lake between San Lucas and Panajachel, but which failed almost

THE GREAT TURTLE AT QUIRIGUA

This is, perhaps, the most extraordinary of the monuments at Quirigua. It is a cube about 8 feet in diameter, and weighs about 20 tons. The carvings are grotesque representations of animals

before it began. Easy chairs and hammocks lend a homelike look to the long vine-covered porches, and in this quiet spot the days slip by unheeded and one forgets the busy world beyond the towering hills.

By daylight the beauty and grandeur of the scene, although robbed of the charm and mystery of the moonlight, was none the less perfect.

Lying at an altitude of 5,000 feet, about 25 miles in length, this body of water has no visible outlet, although many streams empty into it. Its depth is unknown; no fish live in its icy waters. Here and there mineral springs bubble to the surface, and the shores are strewn with pumice and stones of volcanic origin. Eleven Indian towns, named after the Apostles, dot the shores, but by far the most interesting is the town of Atitlan, lying snuggled on a beautiful bay running inland between the two great volcanoes. The ground here is a mass of rocks and stones, undoubtedly the result of some volcanic disturbance, and these, loosely piled one upon the other, serve as walls for the huts, which are topped by thatched roofs. As one approaches, the first impression is that of a gigantic patch of huge mushrooms.

Here 10,000 Indians, descendants of the once poweful Quiché nation, live entirely to themselves, having an "alcalde," or governor, of their own tribe. Among them one sees more marked the peculiar and unaccountable resemblance to the Chinese, which is more or less noticeable in all of the Indians throughout the country. It is whispered that these people are fire-worshipers, but that civilization and religious teaching at one time penetrated to this far-away corner is evidenced by the ruins of a church, now standing empty and unused in the center of the town. The interior still contains some fine wood carvings and beautiful altar silver.

Never, even among the poor of Italy, have I seen so many children. We were at once surrounded by a throng of them, who accompanied us everywhere, chattering like a lot of monkeys.

The costume of these people is very effective against the dull gray background of rocks and thatched roofs. It consists only of a long piece of scarlet cloth wound tightly around the lower limbs and a loose white "guipele," or shirt. The women wear a scarlet ribbon or narrow piece of cloth wound through the braids and around the head.

Solola, a town of 15,000 inhabitants, and capital of the province of the same name, lies some 3,000 feet above the lake. Although a center of commerce, it affords little of interest to the visitor, except the magnificent view of lake and country. A large bare plaza, a ruined church, and a broad new avenue leading to a new school-house, which is painted a brilliant sky blue, are the chief attractions of the place.

As we rode into the plaza a military band was playing, but upon our arrival the musicians hurried frantically to the end of the piece and then gave themselves up to staring open-mouthed at us. We dismounted and walked through the public gardens, a most melancholy attempt at embellishment, as the stiff flower beds were without flowers and the fountains, like the school-house, painted bright blue, were without water. The place was on the whole depressing, and, to raise our drooping spirits, we indulged in a two-step down the deserted central allée to the strains of a *Sousa* march—whether played in our honor as "Americanos" I do not know.

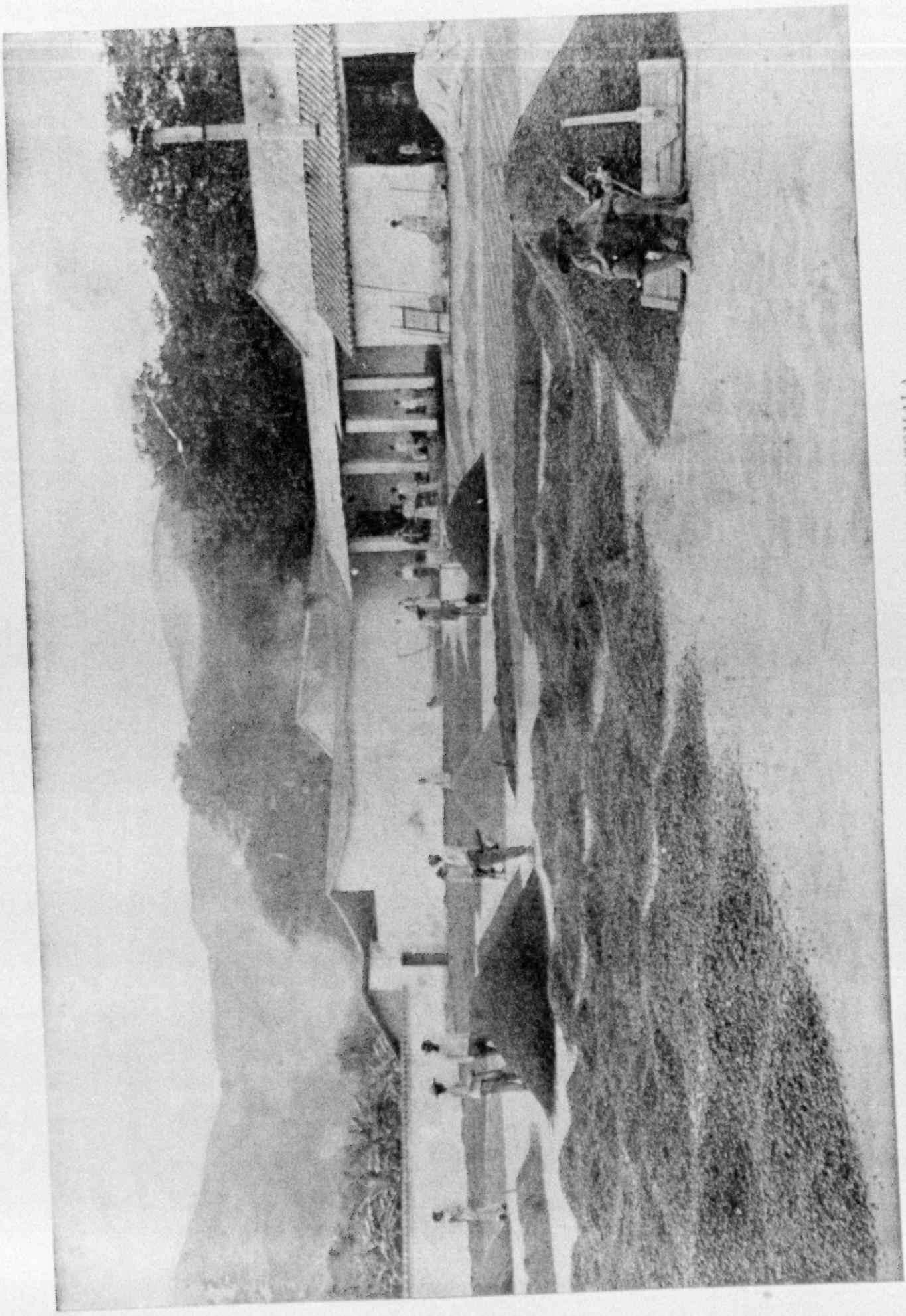
We were, however, well repaid for the ride. It has been my good fortune to look down upon many lakes in different parts of the world, but never have I had spread before me a more gorgeous panorama, earth, sky, and water outvying each other in deepest sapphire tones, and seven magnificent volcanoes dominating the wonderful scene.

Lake Yzabal is reached by a line of steamers, owned by a German syndicate, plying regularly between Livingston on the Caribbean and Panzos in the interior, on the Polochic River. For the first ten miles we follow the winding course of the beautiful Rio Dulce, or Sweet River,

XUM

ONE OF THE CARVED MONOLITHS OF QUIRIGUA, GUATEMALA (SEE PAGE 624)

None of these remarkable monoliths at Quirigua contain any carving or representation of a weapon of war, which is a proof of the advanced civilization and culture of the unknown people who constructed them. The illustration on this page and on pages 607, 608, 610, 611, and 620 are from "A Glimpse of Guatemala," by Anne C. and Alfred P. Maudsley.



DRYING COFFEE ON A PLANTATION IN GUATEMALA

renowned for its scenery, which is very like that of the far-famed Saguenay, in Quebec.

On each side perpendicular walls of green rise to the height of 300 to 400 feet, and at times so inclosed is it that it seems the boat must run in among the trees and overhanging vines. Then the river broadens and we come out into what is called the Golfete, a pretty body of water ten miles in length and dotted with numerous islands; through another narrow channel and out into the lake proper. Here stands the old ruined fort of San Félipe, built by the Spaniards in 1524 to guard the approach to the town of Yzabal, which used to be the principal port of the Atlantic coast. A sand bar, however, has formed across the mouth of the Rio Dulce, which prevents any large-sized vessels from reaching this inland sea.

Although of fresh water, many fish come up from the sea, and even shark are sometimes found here. Crocodiles are numerous, and "mantas," a species of hippopotamus, commonly called sea-cow, are also found. All the way up the Rio Dulce one sees by the hundreds the beautiful white "garza," the lovely bird from which is taken the much-desired and expensive aigrette.

Much further to the north, in a wild and sparsely populated part of the country, lies the lake of Peten, or San Andrès, of which, as yet, very little is known. On an island in the center of the lake is the city of Florès, known only to antiquaries. Here are many curious ruins and stone idols, the origin of which is as yet unknown.

There is a vast field for research in this country, where little is known of the races who were its first inhabitants. But that the ancient American civilization was highly developed is a fact beyond doubt, for the remains of numerous prehistoric cities have been discovered throughout Central America.

THE INEXPLICABLE RUINS OF QUIRIGUA

Among the most remarkable are the ruins of Quirigua, in Guatemala. Situated in the valley of the Motagua River, some 60 miles from its mouth, they are completely hidden in a thick tropical jungle, and consist of square and oblong mounds and terraces.

The chief interest, however, centers in several carved monoliths, three to four feet square and standing from 14 to 25 feet in height. The as yet untranslated hieroglyphics on these bear some resemblance to the Egyptian, although curiously enough the Greek cross can be also traced.

Many theories have been advanced as to the origin of the people whose wonderful works still stand amid the silence of the primeval forests, shrouded in the mystery of ages. There is, of course, much controversy, some ascribing to these ruins great antiquity, while others assert that they are of comparatively recent construction. No traditions have been found among the Spaniards or the Indians to shed any light upon the subject. The people who built them seem to have had a distinct, independent, and separate existence. Much attention has been given to the deciphering of these inscriptions, but still much remains to be done before the mystery will be solved. Some may date back 3,000 years or more, while the later dates on others of the Quirigua ruins may be assigned to a place at the beginning of the Christian era.

And so with the poet we can well say:

"World wrongly called the new; this clime was old
When first the Spaniards came in search of gold.
Age after age its shadowy wings have spread,
And man was born, and gathered to the dead;
Cities rose, ruled, dwindled to decay,
Empires were formed, then darkly swept away;
Race followed race, like cloud-shades o'er the field,
The stranger still to stranger doomed to yield."

Photo by Robert Shields

A NATIVE VILLAGE IN THE INTERIOR OF ANGOLA

ANGOLA, THE LAST FOOTHOLD OF SLAVERY

ANGOLA, the Portuguese colony on the West Coast of Africa, is a country about as large as France, Switzerland, and Italy combined. Its coast-line on the Atlantic is nearly 1,000 miles in length and has many good harbors. For every thousand people who have heard of the Congo Free State, which borders on the east and north, it is possible that two have heard of Angola, and perhaps one of those knows that from a time some score of years before the inauguration of the Congo State to the present day there has existed in that country a system of slavery which is only comparable with that of the Spaniards in the West Indies. Slaves are brought down from the far interior, often as far as 800 miles, by agents who think they have done well if one-half of their drove survive the journey. At the coast, knowing that it is impossible for them to return home, the slaves bind themselves to a term of service—"indentured labor," it is called—which never ends, and are shipped to the cocoa plantations of the islands of Saint Thome and Principe.

Angola is classed as a country poor in natural products of the soil and in minerals, but still moderately rich in men, in spite of having been squeezed for generations by the Portuguese. The principal agricultural products are manico, coffee, bananas, sugar-cane, and tobacco. The trade is mostly with Portugal, the chief exports being coffee, rubber, ivory, wax, fish, and palm oil.

The capital of Angola is Loanda, or

Photo by Robert Shields

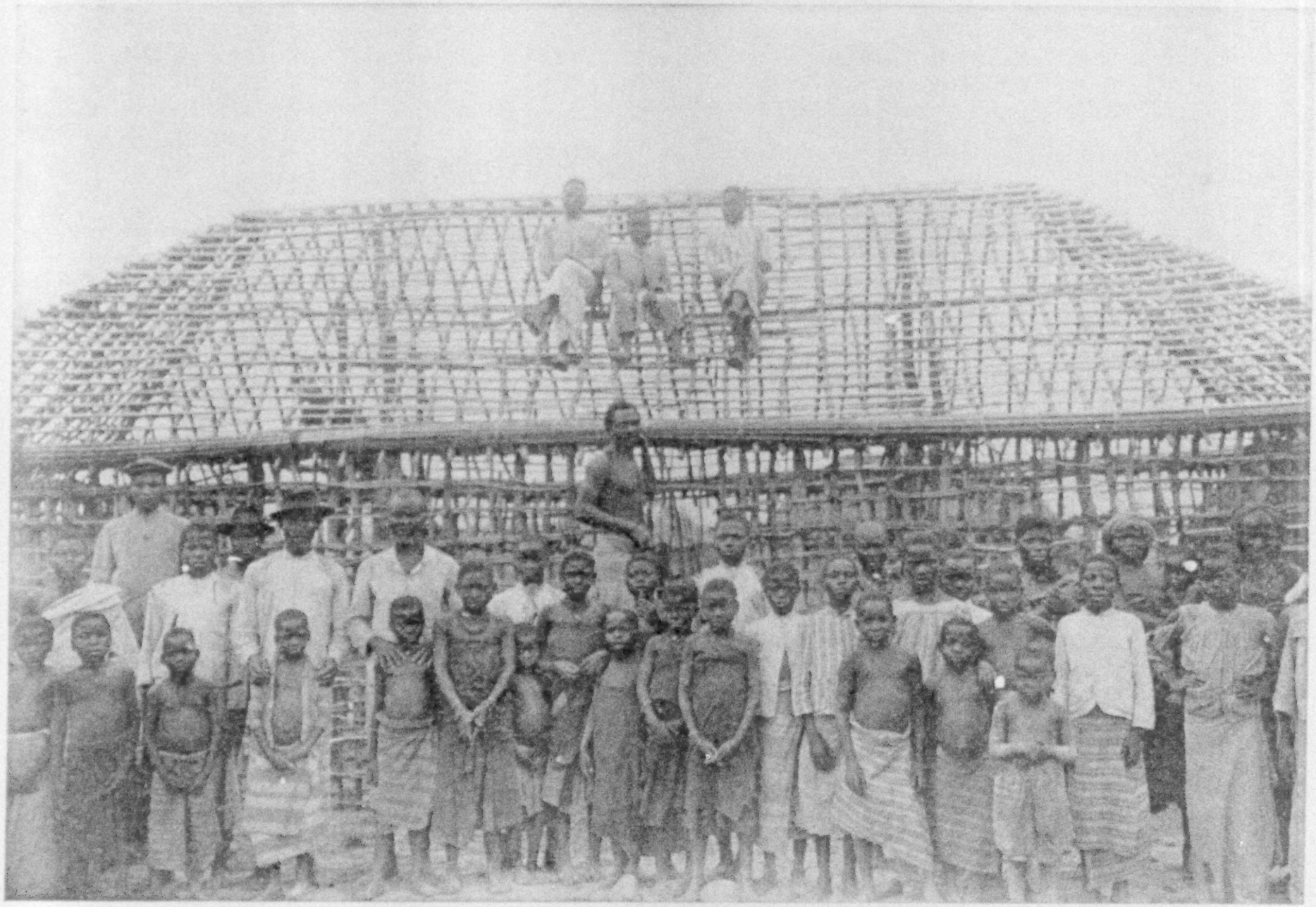
A CHRISTIAN FAMILY OF LOANDA, THE CAPITAL OF THE COLONY

Saint Paul de Loanda, as it was christened, the oldest Portuguese settlement south of the Equator and once the center of the slave trade between Africa and Brazil. Its splendid harbor offers a safe haven, and it boasts of a mixed population of about 25,000. For administrative purposes the colony is divided into five districts, and at the head is a governor appointed by the Portuguese. The population is estimated at 5,000,000, the greater portion natives, and the number of Europeans being only about 4,000. They have, however, exercised a great modifying influence on the native population inhabiting the western part of the colony as regards their customs and economic condition.

Photo by Robert Shields

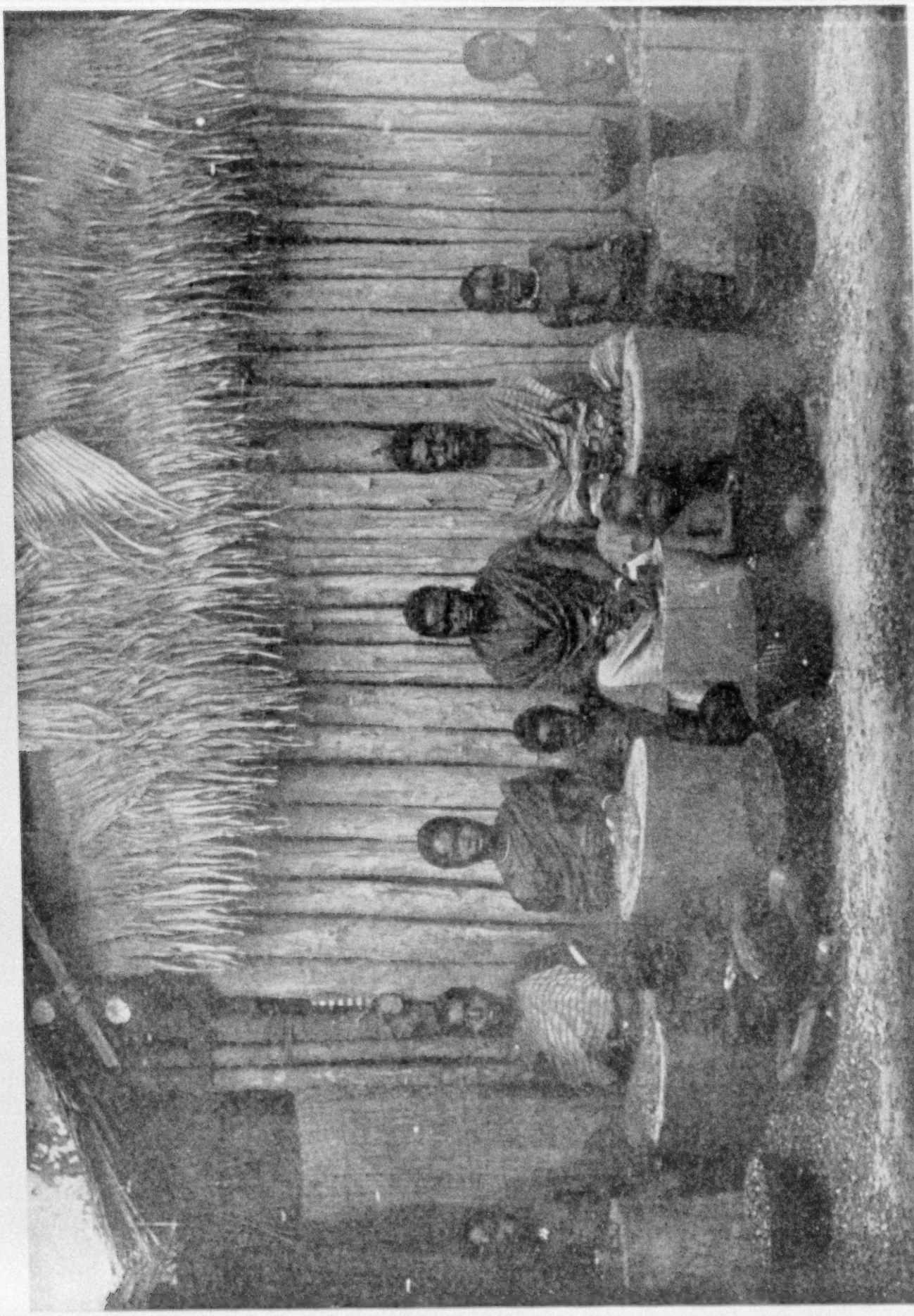
TWO NATIVE WOMEN RETURNING FROM THEIR FIELDS: LOANDA

The woman on the right has been carrying her baby strapped to her back while she worked in her own fields. Polygamy prevails among the natives, and every wife has her own house, garden, and private property.



A NATIVE HOUSE IN COURSE OF CONSTRUCTION IN ANGOLA

Photo by Robert Shields



NATIVES CRACKING PALM-KERNELS FOR THE MARKET: ANGOLA Photo from Bishop J. C. Hartzell

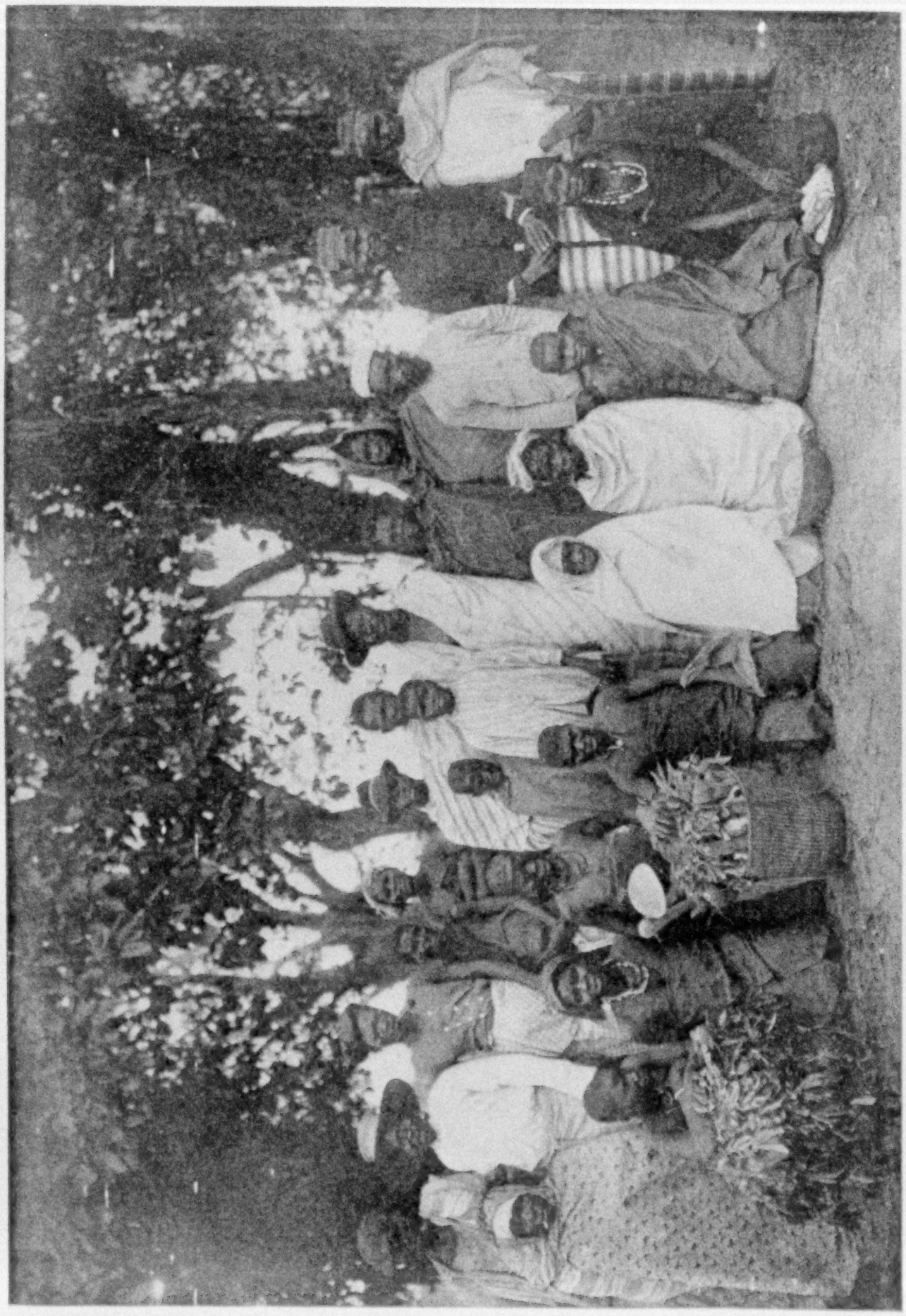
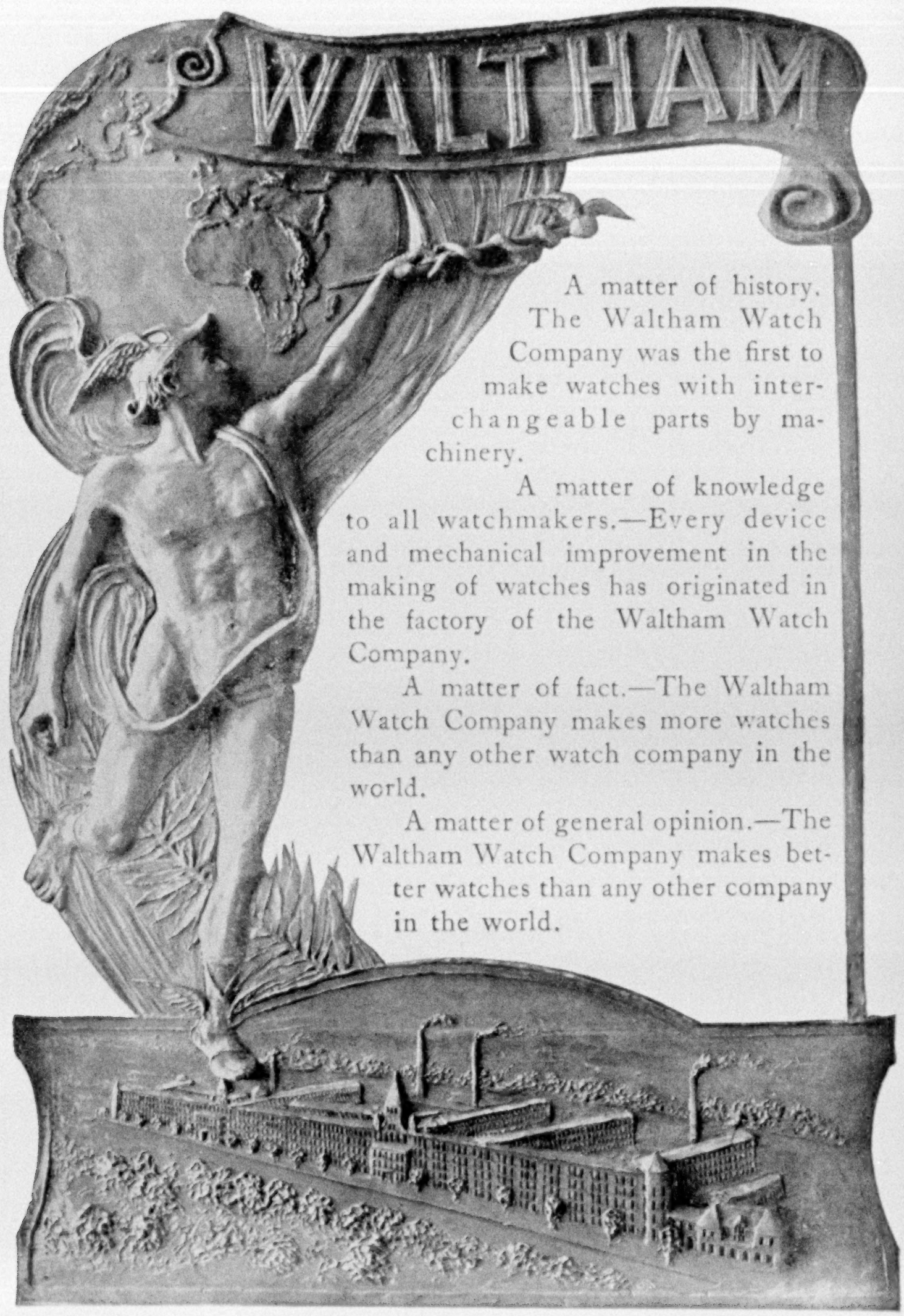


Photo by Robert Shields

NATIVE CHIEF WITH HIS PRIME MINISTERS AND A FEW OF HIS SUBJECTS IN ANGOLA



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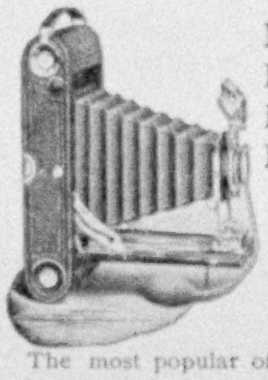

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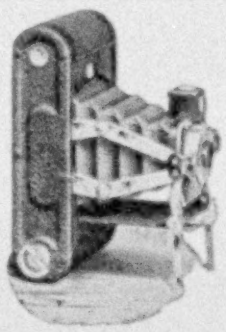

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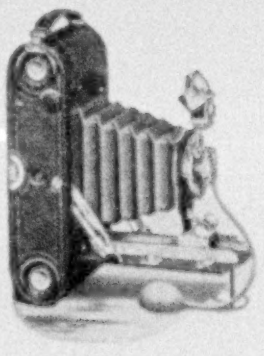

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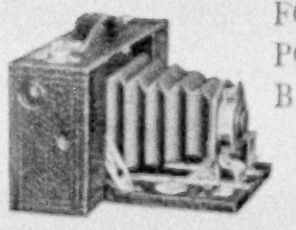

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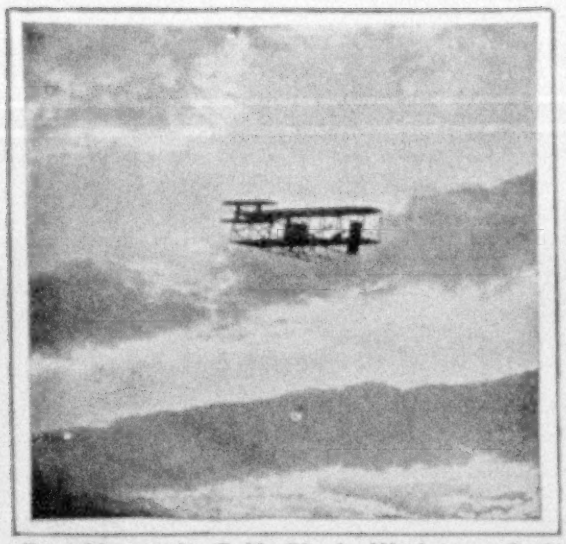

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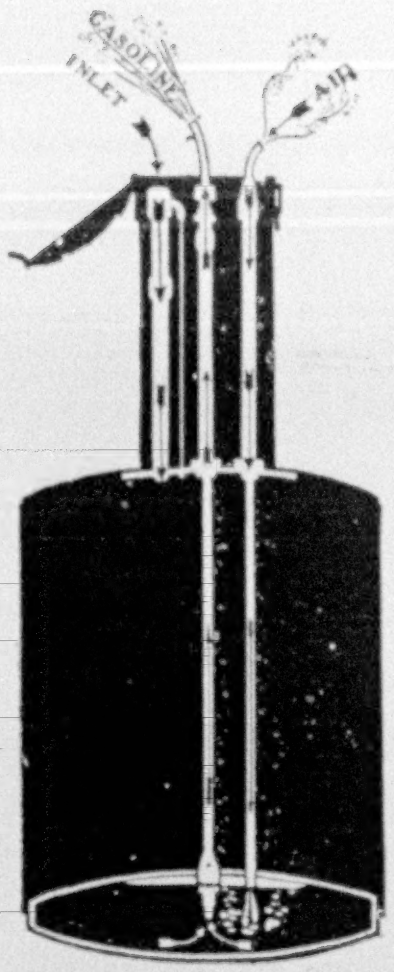

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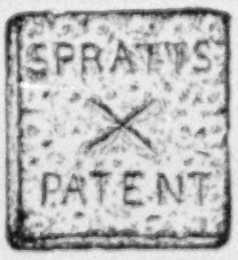

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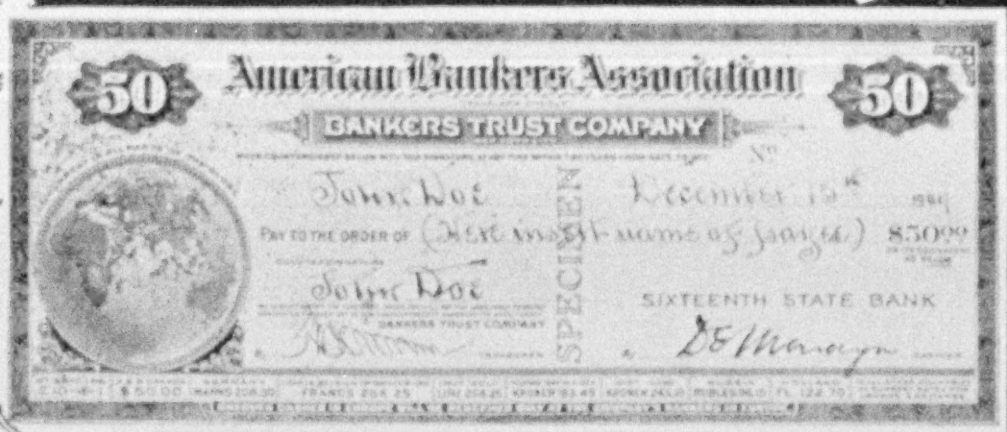

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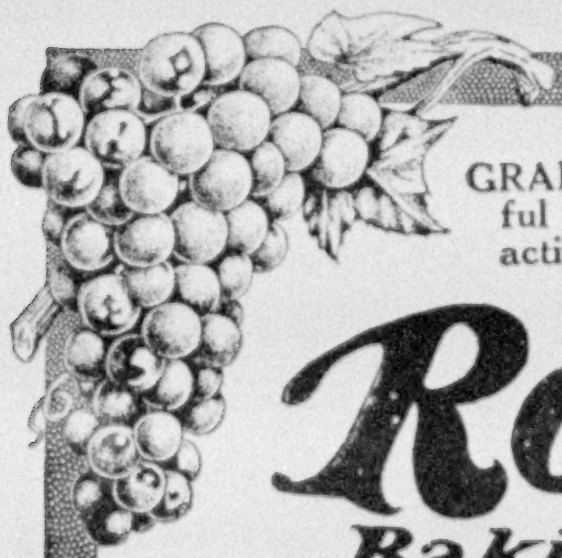

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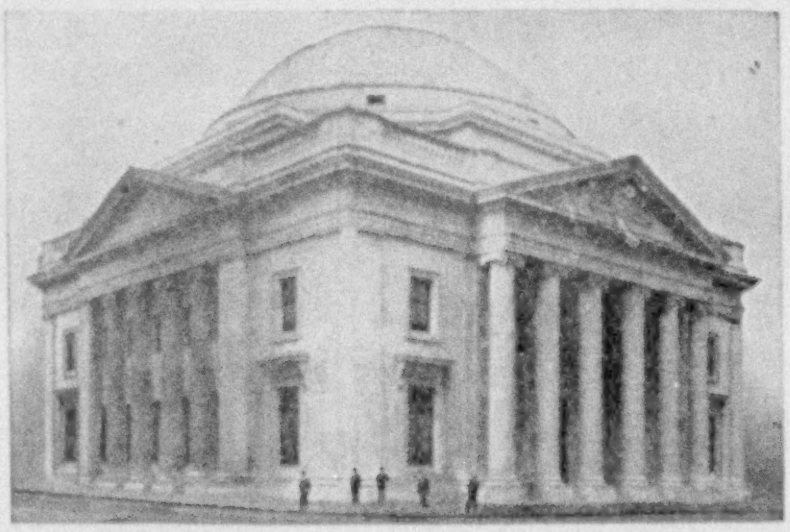

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